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*New York, December 8, 1928*

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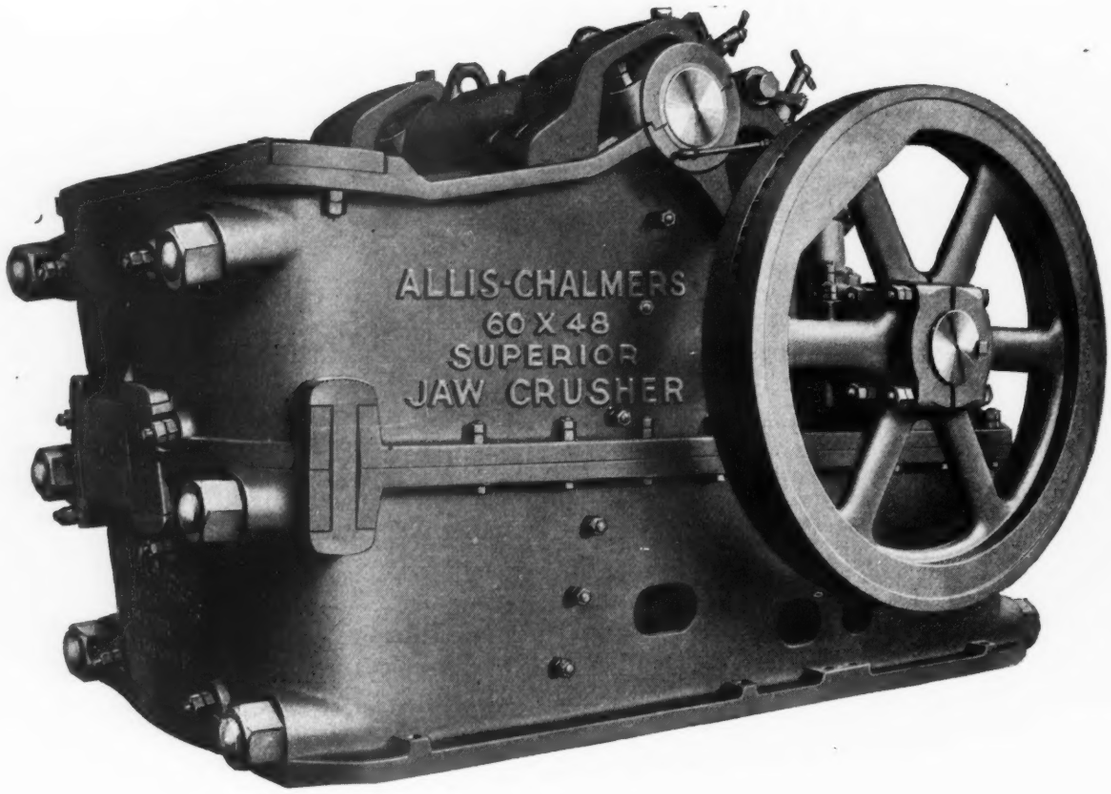


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A. W. ALLEN,
*Editor*

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## Water as a Factor in Technical and Social Advance

WATER has played an important rôle in the amazing developments witnessed in recent years in the metallurgical and chemical industries. Primitive metallurgical practice involved a crude system of rock crushing, usually followed by a smelting treatment. Early chemical methods undoubtedly took advantage of the extraction possibilities in percolating a liquid through a permeable mass of ore; but it was not until the pioneer cyanide engineers perfected a simple and efficient system for the wet extraction of gold, permitting progressive enrichment of the solution and progressive impoverishment of the residue, that scientific leaching and filtration in a continuous process became recognized as a valuable working tool.

Crushing in water obviated most of the serious drawbacks of former practice; but it added another problem —the production of slime and the release of colloid substances—that spurred metallurgists to increased efforts and led to the invention of basic equipment that today permits the close classification of matter in the colloidal state from crystalline slime, of slime from sand, of sand from gravel, and the separation of an almost infinite variety of materials of different specific gravities or different physical characteristics; of equipment that dewaters the sand or the slime or the concentrate, or recovers from either a valuable solution; of equipment that screens, mixes, washes, separates, clarifies, and delivers a final product or a series of final products, as required and as desired, in almost uncanny precision.

Incidentally, the elaborate technique developed in this connection has been found applicable to a wide variety of operations in the processing industries that, in these days of intensive competition, are looking to the scientist and the technician for help. Research is catholic in its application, yet the results are invariably found to be based on certain definite fundamental laws and principles that have been demonstrated of essential importance only in comparatively recent years.

The most valuable adjunct to the research laboratory, in the industrial plant and in daily life, is plain water. It is the universal vehicle for a thousand and one techno-industrial processes—as a medium for pulverization, purification, dissolution, transportation, classification, crystallization—to mention but a few of the basic phases in the processing or the treatment of a raw material, metallic or non-metallic, organic or inorganic, in the crystalloidal or in the colloidal state. Modern comminution, in its most highly developed form, is wet grinding. The most successful modern method of concentration is dependent on whether or not a mineral particle is wetted or not wetted by the water in which it is crushed. Modern hydrometallurgical practice invariably uses an aqueous solution as the solvent. Up-to-date ceramists find that real separation of clay from silica contamination by continuous methods is possible only in water. A thousand similar examples might be cited from the industro-engineering field.

As a result of the wider use of water, the average span of life is longer, and the world is a cleaner place in which to live. All the developments outlined have occurred in what might be termed the age of research—in that period when advantage has been taken of the vast potentialities of water as an adjunct to advancing civilization. Experience has led to the acquisition of a co-ordinated, scientific knowledge of the behavior of the solids in liquids and to the development of apparatus and a technique that may be successfully and economically applied to a broad range of industrial activities.

## Faith, Persistence, and Mineral Discovery

PERSEVERANCE was the basic reason for the recent success at the Kettleman Hills structure, southeast of Coalinga, California, where a gusher was brought in at a depth of 7,096 feet. The well, started in March, 1927, reached oil sand at a depth of 7,236 feet on April 15, 1928, but it caved because casing was in place only to 5,200 feet. Subsequent efforts brought the well in as stated. In this instance, to continue drilling required courage and faith. According to the *Standard Oil Bulletin*, oil was thought to exist in the Kettleman Hills area, but no one had found it there in commercial quantities, although many efforts had been made. About 25 wells, exclusive of many under 2,000 feet, were drilled; the first deep test was abandoned in 1910 after reaching 4,100 feet.

Whether or no a new commercial oil field has been discovered remains for further drilling to prove. Opinion is optimistic. The significant fact is that, although the structure of Kettleman Hills was favorable, efforts over a long period proved discouraging.

Success in the extension of metal mining will require this same abundant faith and persistence in an attack on new areas where neither surface indications nor geophysical findings are in evidence, but where a broad geological study warrants a favorable conclusion. The growth of knowledge in economic geology is developing a background for a visualization of conditions under which mineral deposits occur. The application of this knowledge calls for shrewdness in the selection of men to take advantage of this fund of information, and adequate capital.

## The Lubricant That May Not Lubricate

WITH winter at hand the problem of lubrication assumes a new importance. The oil or grease that has been giving satisfaction since early spring may not do as well with the mercury at lower levels. Lubricants, like individuals, may differ greatly: They have their physical limitations, and will not function properly if unsuited to conditions. Trouble may be looked for wherever machinery is exposed to weather and low temperatures. The wise operator will give the matter due attention.

Too often lubrication is treated in a perfunctory manner. In such cases the responsible individual is likely to be quite matter-of-fact, if questioned: oil to him is oil and grease is grease. Apparently anything sticky will do if only you use enough of it—molasses, perhaps, though he would probably draw the line at glue. Such individuals, however, are less frequently met than formerly. Today they are without excuse. The average salesman is a source of useful information on the selection and use of lubricants. Refiners, in general, are spending large sums yearly to advise industry on how to use their products to best advantage. Their advice may be regarded as free from bias and technically sound. The refiner knows that it will not pay him in the long run to urge the use of the wrong lubricant, no matter what the immediate profit. On the other hand, the consumer should realize that penny-pinching when buying oils and grease may also be unprofitable—to himself. The cheapest, of course, may not be the best; it is more likely to prove the worst. Use of proper lubricants, even if expensive, is equivalent to insuring smooth operation, comparative freedom from repairs, and long life to the machinery.

Lubricants, moreover, should be chosen according to the kind of equipment to be lubricated. The same grade or brand will not necessarily be suitable in every instance. The wide variety of grades on the market makes it possible to secure the particular oil or grease that will give the best results. Here, in selection, is where competent advice is needed, inasmuch as the number of grades and brands is confusingly large.

In this respect the practice of refiners might well be simplified. The production of fewer grades, each conforming closely to standardized specifications and suitable for a particular range of service, would be advantageous both to refiner and consumer. Moreover, the adoption of standard nomenclature for brands would be useful in that it would permit the ready correlation of competitive products and so facilitate selection.

## The Mysteries of Legal and Patent English

LAWYERS and attorneys have long been accustomed to shield their work behind a smoke screen of turgid and verbose phraseology, creating the impression thereby that they are endowed with a special genius for the registration of fact and the transfer of thought by means of the written or printed word. Those of their clients who have suffered from headaches and depleted bank accounts because of misinterpretation of legal documents will indorse the recent action of the United States Supreme Court—in returning briefs to certain prominent attorneys for the City of New York and for the transit companies operating therein, with the curt instruction to condense by the deletion of irrelevant matter and to clarify by the adoption of a more intelligible construction. In many quarters this has been interpreted as a humiliating rebuke to attorneys in general, especially because it comes from within their own profession.

The spirit of such a reform as that hoped for might well spread—to those members of the bar, for instance, who delight to inject into a patent document enough irrelevant matter to make the account as complicated as possible, using words and phrases that merely indicate an adherence to a traditional form that obscures the essential features of the invention and the discoveries of the inventor; and utilizes (or disregards) punctuation in a manner that "makes confusion worse counfounded." As a climax, a superfluity of claims are usually appended, many of which are meaningless to the inventor and to the average reader. The net result is to clutter the business of the patent office with disputes and arguments that are inevitable when a deliberate attempt is made to be legally clever in the use of words, thereby delaying action on all applications and encouraging expenditures that are remunerative to no one except, possibly, the patent attorney.

## An Executive With a Thousand Eyes

ENGINEERING involves a scrupulous regard for accuracy; the engineer's training insists on the importance of efficiency. His respect for detail may cause him at times to miss the broader aspects of a project, but he gets the details. In short, he symbolizes precision and efficiency. Guesswork is foreign to his philosophy. These are statements, rather than idle compliments. The application of science to industry necessitates accuracy of survey and deduction, precision of record, and efficiency of operation. The engineer is well suited for the task.

In the efficient operation of the plant, therefore, the engineer naturally turns to instruments of precision to aid him in his work. Failure to do so would mark him as unprogressive; or it would indicate that he was ignorant of the advances made in recent years by makers of such equipment. The survey of the use of automatic indicating and recording instruments by the mining industry, which appeared in *Engineering and Mining Journal* of November 3 and 10, demonstrated their wide usefulness and application, but it showed also that some engineers and superintendents were more alive to opportunities in this direction than were others.

Watchfulness is a characteristic of the careful executive. But modern plants are extensive, and the superintendent must often do his watching through the eyes of others. The recording instrument affords him another method of watching; it multiplies his eyes. It eliminates the distance between him and the point where the observation is made for him. To his technical eye it is television of a sort.

Only a few of the many types of instruments designed for controlling operations were covered in the survey mentioned. Many others are worthy of investigation and trial. For example, research and invention have placed at the disposal of the metallurgist or the chemist the instrumental means for determining acidity and alkalinity of solutions, accurately and promptly, thus increasing his ability to control efficiently a process such as flotation or cyanidation. An account of the devices available for this purpose appeared in the issue of November 24, but a large volume would be required to set down all the achievements of instrument makers within the last decade.

## Health Preservation as Important As Accident Prevention

THE creation of a National Institute of Health is proposed in a bill introduced by Senator Ransdell, of Louisiana, and now on the Senate calendar of business to be considered during the forthcoming short session, according to *Science*. The bill has been approved by the Senate Committee on Commerce, which reported as follows:

"The object of this bill is to promote the health of human beings, to improve their earning capacity, to reduce their living expenses, to increase their happiness and prolong their lives.

"It seeks to prevent disease by ascertaining its cause and applying preventive measures in advance of its outbreak. It has unselfish interests to serve, and its beneficent results will enter every home in the nation.

"It appreciates that disease is universal and ignores state and national lines; hence it seeks to establish in this Capital City a great national institute of health in the belief that it will become a clearing house of health for all the world.

"It has received the indorsements of distinguished men of science, and of the national organizations of related scientific research.

"The bill contains three distinct features.

"First, the creation of a National Institute of Health in the Public Service under the administration and control of the surgeon-general, for the special purpose of pure scientific research to ascertain the cause, prevention and cure of disease affecting human beings. It does not create any new bureaus or new commissions, but utilizes existing government machinery and provides for much enlargement of the hygienic laboratory, which is merged in and made an essential part of the National Institute. It authorizes appropriation of such sums as may be adequate to carry out the provisions of the measure.

"Second. It authorizes the Treasury Department to accept gifts unconditionally for study, investigation, and research in problems relating to the health of man and matters pertaining thereto, with the proviso that if gifts in the sum of a half million dollars or more are made, the name of the donor shall be attached thereto.

"Third. It proposes the establishment and maintenance in the institute of a system of fellowships in scientific research in order to secure the proper scientific personnel and to encourage and aid men and women of marked proficiency to combat the diseases that menace human health."

In conclusion the committee reports:

"We are disposed to feel hopeless over the time required for the solution of these intricate and difficult problems of the health of the individual. Yet the necessities of war gave us clear illustration that when researchers in the several sciences are brought together and given adequate facilities and full time for research, results can be accomplished at a speed hitherto undreamed of.

"Surely we would be unfaithful to our responsibilities if we do not profit by this striking example and apply similar defenses for the battle of man with disease. Our failure to act will mean a deliberate sentence of sorrow and suffering in the homes of our constituents.

"Favorable action will mean an effective start along the road which ultimately will lead to successful solution. As an economic question, there can be no difference of opinion on the wisdom of such an investment of public funds; as a social question, none can equal it in importance."

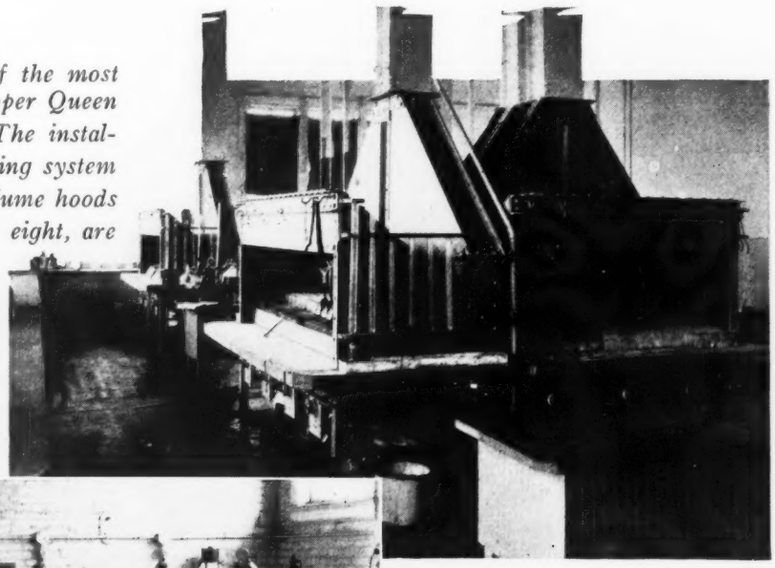
The fine record of some mining companies in improved health conditions for underground and surface workers contrasts with the attitude of the majority—that it were best to ignore the subject rather than to invite attention to what might be judged as an unsatisfactory condition. Good ventilation underground is impracticable; the conditioning of air is too costly; dust control is a fad; the spread of communicable diseases is inevitable—these are the arguments sometimes advanced in excuse for a continuation of conditions the effect of which is diminished output, failing morale, suffering, and loss. For hundreds of years the mining industries of the world have performed the ostrich act of burying the head in desert sand to avoid a candid recognition of what is obvious to the world at large. Underground mining is hazardous, but reports and statistics have proved that tremendous advances have been made in recent years in the reduction of accidents. This fine showing should be used as an inspiration and as an incentive for a mass attack on the problems of healthful conditions in mine and mill, by the provision of adequate lighting and ventilation, atmospheric temperature and moisture control, dust collection, medical examination, and hospital service.

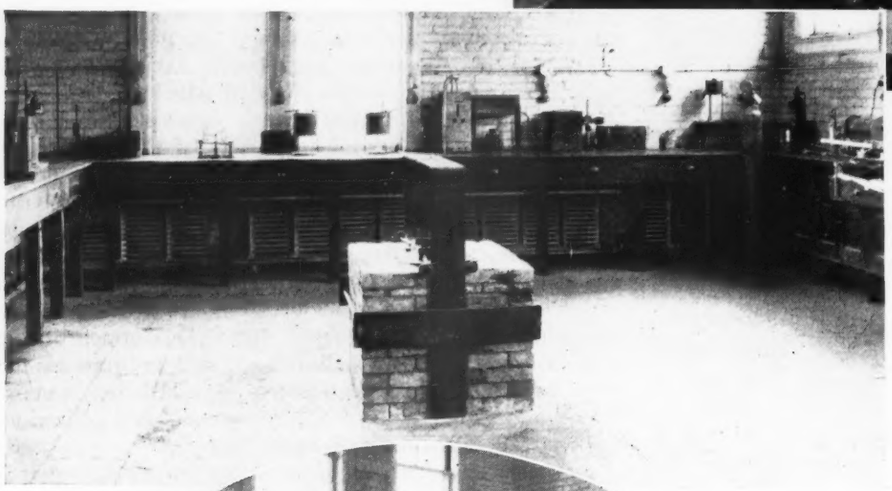
The old conception of requirements in the safeguarding of health was to have a company doctor, supplemented, perhaps, by a company hospital, for curing the ills of employees and their families at little or no cost to the individuals principally concerned. Highly progressive companies sometimes maintained a dentist as well. More recently the safety engineer has come to be as important as the doctor. The prevention of accidents and the maintenance of good health are fundamental to efficient management, and constitute a field in which the company doctor, the safety engineer, and the company officials, as well, should co-operate.

The mining industries of the United States will do well to support the proposed National Institute of Health and encourage those researches on individual-industry problems that have so potent an influence on the health of the country as a whole. Technical and economic progress in recent years has been due in large part to the commendable efforts made to safeguard the worker; but much more needs to be done before the metal-mining industry can be given a clean bill of health. The insurance of health and health insurance are not one and the same. Responsibility for the outcome of unhealthful conditions cannot be evaded by the payment of premiums. Better to face conditions in their reality, meet the monetary loss, and determine to reduce the hazard, as has been done with accidents.

# The Copper Queen Smelter Laboratory

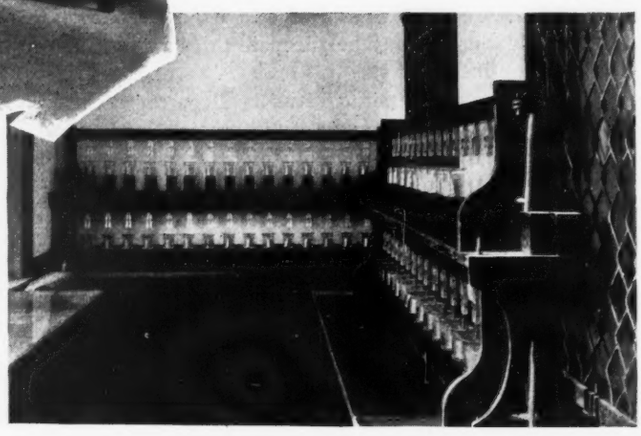
*ADEQUATE ventilation was one of the most important features in equipping the Copper Queen smelter laboratory at Douglas, Ariz. The installation of a modern forced-draft ventilating system was completed about a year ago. The fume hoods shown at the right, of which there are eight, are constructed of "transite" board (pressed asbestos and cement) and steel. Two roof ventilators for removing fumes generated outside the hoods complete the ventilating system.*





*HIGH CEILINGS, large windows, and light paint provide ample air and light in the testing laboratory of the Copper Queen smelter, where a wide variety of research and general testing work is conducted. The equipment includes all the necessary apparatus for testing fuel and lubricating oils, coal and coke, iron and steel, cement, and almost all other materials of construction and operation.*

*IN THE electrolytic room of the Copper Queen smelter laboratory, the equipment is of the stationary electrode type, and is constructed of aluminum, nickel, and wood. Electrode contacts are in the form of clothespin clips, an idea originated by F. G. Hawley, of the International smelter, at Miami, Ariz. A parallel-current arrangement is used to minimize re-solution losses.*



# *Mineralized Volcanic Explosion Pipes*

By R. T. WALKER
*Geologist, United States Smelting Refining & Mining Exploration Company*

IN RESPONSE to some hidden cause, for which Spurr has suggested the name "telluric force," and the nature of which is variously interpreted by geologists, large masses of fluid magma slowly ascend from unknown depths up into, and occasionally through, the solid crust of the earth. The upward progress of the magma seems to be accomplished chiefly by lifting, forcing asunder, and thrusting apart the invaded formations; but this action is accompanied to some degree by the combined process of melting and chemical solution known as assimilation, and it is more or less accelerated by magmatic stoping, whereby slender tongues of magma, insinuating themselves along joints, bedding planes, and other lines of weakness, dislodge blocks of the invaded rocks, which thereupon are engulfed and more or less completely fused by or dissolved in the magma. In the upper parts of the crust, advantage is taken of whatever faults and fissures are encountered that may serve as pathways. Sometimes the magma ascends to the surface along such a fissure, and, issuing quietly, flows forth as streams of lava, constituting what is called a "fissure eruption"; but the more spectacular eruptive phenomena displayed by volcanoes are initiated in a different way.

That igneous magmas are highly charged with steam and other gases is well known, since large volumes are emitted during eruptions. Most of these gases are probably of deep origin, and are primarily constituents of the magmas in which they are contained. Water and atmospheric gases, however, are carried downward into the crust by the vadose circulation, and are also imprisoned in sedimentary rocks during their deposition; so that the engulfment and assimilation of rocks of the crust by ascending magmas may result in the addition of water and gases of surficial origin to the original content.

It seems reasonable to suppose that the uppermost portion or head of the ascending column or mass of magma is more highly charged with gases than the main body; for the lightness of the gases would cause them to rise through the mass of the magma—so far as its viscosity permitted—and to accumulate at the top; while water or gases liberated from crustal rocks, assimilated by the magma, would naturally be concentrated there. The gases at the top of such a magma column would be held in solution by the magma, so far as its capacity in this respect permitted, and any excess would be distributed through it as multitudinous minute bubbles.

The gas pressure at the top of a magma body is likely to be very large; and as such a body of magma approaches the surface, a point is eventually reached where the gas pressure exceeds the strength of the portion of the crust immediately above. Unless some fissure is available up which the magma can readily be forced to the surface, the result is the same as when the pressure of steam inside a boiler exceeds the strength of the boiler shell: an explosion ensues, rupturing the crust at the weakest point.

If the magma were close to the surface at this time, it is possible that the disruption might be somewhat similar in nature to a large quarry blast—the upheaval and shattering of a mass of rock extensive in area as compared with depth. But in all instances with which I am acquainted, the depth of the igneous mass at the critical moment has been so great that the effect was comparable, instead, to what takes place in mining operations when a small charge of powder is exploded at the bottom of a drillhole. Being too weak to shatter the rock into large fragments in the customary manner, the force of the explosion is expended in comminuting the rock immediately contiguous to the drillhole, forming a cylindrical chamber a few inches in diameter—well described by the miners' term "bootleg"—whereas the surrounding rock is unbroken. The holes blown through the earth's crust above a body of magma, when the gas pressure at the top of the magma exceeds the strength of the crust at that point, are similarly pipe-like in form, and hence are termed volcanic explosion pipes.[1]

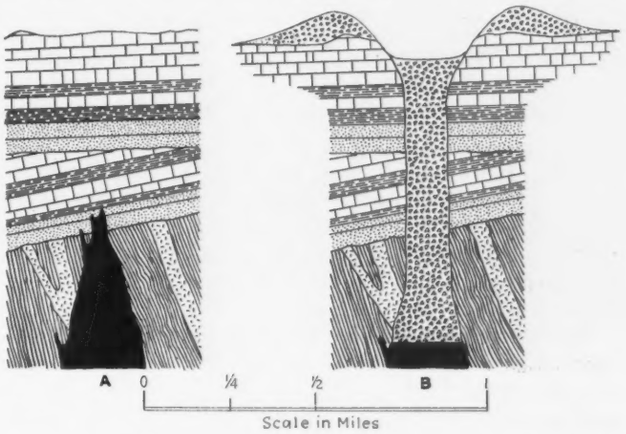



*Fig. 1—Vertical section illustrating the formation of a volcanic explosion pipe. Solid black indicates fluid lava. A. Just before the explosion. B. Just after the explosion.*

The walls of these pipes are nearly vertical, although near the surface they tend to flare out and become funnel-shaped. The shape in cross-section is determined chiefly by whether or not the explosion took place along some

[1]Also known as "maars" or "embryo volcanoes."

*Fig. 2—Volcanic explosion breccia, one-half natural size, Cactus mine, Beaver County, Utah. (U. S. Geological Survey Professional Paper No. 80, "Geology and Ore Deposits of the San Francisco and Adjacent Districts, Utah." By B. S. Butler, Plate XVIII)*

pre-existing fissure. If it did, the shape is likely to be irregularly lenticular, with the long axis, following the fissure, often several times the short axis. Sometimes such pipes are so long and slender as to be almost dike-like in appearance. The pipes which have burst through unfissured portions of the crust usually vary from approximately circular to oval or elliptical in cross-section. Occasionally the shape is quite irregular.

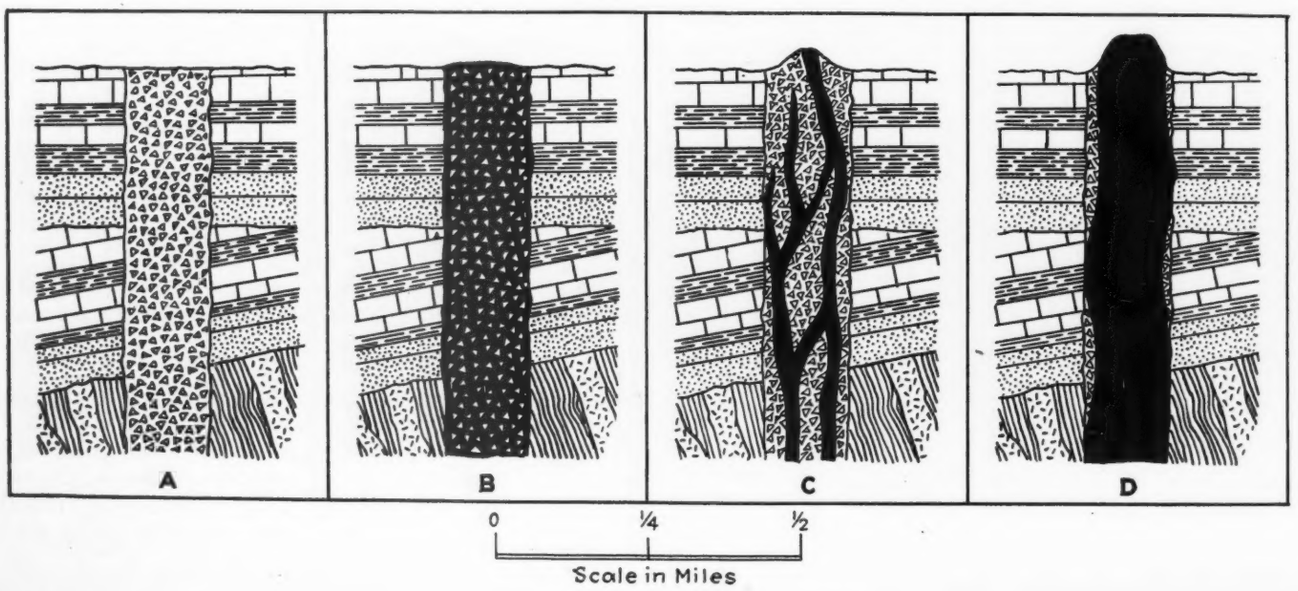
The mean diameter may vary from less than 100 ft. to more than 3 miles, but in the vast majority of pipes it ranges between 500 ft. and half a mile. The depth, of course, is determined by the position of the top of the column or body of magma at the moment of explosion. Where the crust is strong and the gas pressure in the magma low, the magma may approach within a few hundred feet of the surface before the explosion takes place, and the resulting pipe will be correspondingly short. Where the crust is weak and the magma is heavily charged with gases, the explosion may occur when the top of the magma is more than a mile below the surface, thus creating a deep explosion pipe. In every instance with which I am acquainted, the depth of the pipe is several times its diameter.

A noteworthy feature of volcanic explosion pipes is the relatively small effect produced in the surrounding formations; for although they are fractured and often upturned immediately adjacent to the pipe, they are usually undisturbed beyond a distance of 100 ft. The pipes are always filled with explosion breccia or with subsequently intruded magma; so what is known as to their characteristics has been in part learned from pipes that have been dissected by erosion, but has been principally revealed by mine workings that penetrate them.

Formation of a volcanic explosion pipe over a tongue of magma, in which the gas pressure surpasses the strength of the superjacent crust, is illustrated diagrammatically in Fig. 1. The immediate effect of such an explosion is the brecciation of the rock constituting the crust at this point, while coincidently the instantaneous expansion of the gases distributed through the uppermost portion of the magma rends the latter into small particles, which accompany the crustal fragments in their upward flight. The débris, falling earthward after the moment of explosion, tends to fill the pipe more or less completely and to form a ring around its mouth. In most instances the initial explosion is followed by others, at intervals of a few hours or days for a short period thereafter, as gases migrate upward from deeper portions of the magma toward the relief vent thus established, until the gas content of the magma, and consequently its gas pressure, is sufficiently reduced. In the volcanic explosion breccia thus formed, the fragments are chaotically mingled and

*Fig. 3—Illustrating stages in the evolution of volcanic explosion pipes.*

*The tops are shown as eroded. Solid black indicates solidified lava A, occupied only by explosion breccia. B, Explosion breccia cemented by lava, filling the interstices between the breccia fragments. C, Explosion breccia penetrated by dikes. D, Explosion breccia almost completely displaced or assimilated by a column of lava, forming a volcanic vent. The second stage does not necessarily precede the third or fourth stage, nor the third, the fourth.*



diversely oriented. They vary in size from the finest dust up to blocks several hundred feet in length, although in most pipes it is uncommon to find pieces larger than 4 ft. in diameter, and most fragments do not exceed 3 or 4 in. The size of the crustal fragments depends chiefly upon the strength of the rocks constituting that particular portion of the crust; so far as the material derived from the exploded, gas-charged top of the magma column is concerned, the physical condition of the latter is important. Fluid portions of the magma involved in the explosion will be represented in the breccia as small glassy grains or pieces of pumice. If crystallization had begun, isolated crystals or parts of crystals will be seen; and if some portion of the magma had solidified, large fragments of it will be present.

If there is but a single explosion, there is likely to be a roughly vertical arrangement of the fragments in the explosion pipe, according to their original position. In such a circumstance, the breccia in one part of the pipe may consist almost wholly of one kind of rock, which may differ from that above and below; and the upper section of the pipe is likely to be occupied almost exclusively with fragments derived from the crust, while with depth the percentage of derivatives from the magma increases. Where there have been repeated explosions, however, as seems to have been the case in most instances, the fragments may be more or less thoroughly mixed in the successive upheavals.

## Evolution of Volcanic Explosion Pipes

In Fig. 3, *A, B, C* and *D,* the successive steps in the evolution of volcanic explosion piles are shown diagrammatically. If the forces which have been responsible for the intrusion of the magma into the crust happen to have expended their potency at the time of the initial explosion or series of explosions, the pipe will remain filled with explosion breccia, and will be marked on the surface by a depression encircled by a ring of débris. This will be distinguishable from a volcanic crater only by the fact that there has been no effusion of lava. Subsequent erosion may remove these surface indications, as well as some portion of the pipe itself, leaving only an outcrop of breccia to mark its position and indicate its shape. (Fig. 3 *A*). During historic times, many explosion pipes of this type have been formed. One of the most noted is Monte Nuovo, a crateriform hill 480 ft. in height and half a mile in diameter, 8 miles from Naples, Italy, which was formed in 1538 A.D. during a single week—mostly in twelve hours—by a series of explosions of the nature described. Hundreds of ancient explosion pipes, formed in past geological epochs, and now represented only by breccia-filled sections exposed by erosion, have been found.

If, after the initial explosion which forms the pipe, the telluric pressure, which has caused the ascent of the magma from profound depths, continues to be effective, the first result is likely to be the penetration of fluid magma for some distance upward through the interstitial spaces between the breccia fragments occupying the pipe. If the upward advance of the magma then ceases, the breccia will be cemented by lava as far upward as the latter has penetrated (Fig. 3 *B*). This stage is illustrated by several volcanic explosion pipes in the Leadville mining district, Colorado,[2] in which the breccia, consisting of fragments of all the rocks traversed by the pipes, is cemented by rhyolite, which also extends outward as dikes along fissures intersected by the pipes. These pipes are post-mineral, as is indicated by the fact that orebodies are cut off by them and that broken fragments of ore occur in the breccia. Fig. 4 shows a vertical section of one of these pipes, known as the "Ollie Reed" pipe, which is rudely elliptical in plan, with major and minor diameters of 2,000 and 900 ft., respectively, and which has been explored by mine workings to a depth of 900 ft. below the surface.

A further step in the evolution of volcanic explosion pipes occurs when the upwelling magma forces its way

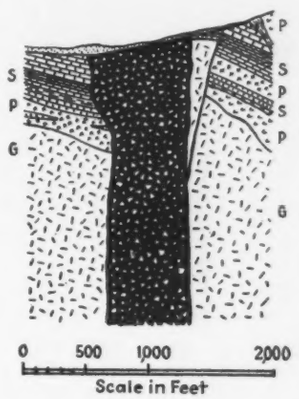



*Fig. 4—Vertical section of the Ollie Reed pipe, Leadville district, Colorado.*

*P—Tertiary porphyries; S—Palaeozoic sediments; G—Pre-Cambrian granite. (U.S.Geological Survey Professional Paper No. 148. "Geology and Ore Deposits of the Leadville Mining District,Colorado." By S. F. Emmons. J. D. Irving and G. F. Loughlin. Fig. 12).*

through the breccia filling in the form of dikes (Fig. 3 *C*). These dikes may be separate, or may form an irregular network penetrating the breccia, or may radiate from a common center. In some instances they extend beyond the walls of the pipe. This type of volcanic explosion pipe is illustrated by Agathla Needle, a prominent natural landmark in northern Arizona. The breccia filling of the pipe, consisting of fragments of basic igneous rocks and metamorphosed shale and sandstone, traversed by dikes and sheets of basalt which expand and contract, branch, coalesce, and intersect in an intricate manner, has resisted erosion better than the surrounding sedimentary beds, and forms a massive monolith towering 1,225 ft. above the surrounding country.[3]

A variation in this type of volcanic explosion pipe occurs when the lava penetrates the breccia in the form of a cylindrical pipe, instead of a dike. This is probably due to the fact that, after a period of quiescence following the original explosion, during which the breccia becomes somewhat cemented, a later and minor explosion creates a smaller pipe within the confines of the earlier one, which is utilized as a pathway by the ascending lava.

The next stage in the evolution of volcanic explosion pipes occurs when, as a result of continued subterranean pressure on the magma, the breccia filling of the pipe is gradually assimilated or forced upward by the magma, which occupies the pipe behind it, and which, eventually reaching the surface in this manner, initiates true volcanic activity, featured by the issuance of streams of lava and the building of a volcanic cone (Fig. 3 *D*). In 1903 the filling of the vent of the volcano of Pelée, on the island of Martinique, in the West Indies, was gradually forced upward in the manner described—for several weeks at the rate of over 40 ft. a day—until eventually it towered above the rim of the crater as a monolith 1,200 ft. in

[2]U. S. Geological Survey, Professional Paper 148, "Geology and Ore Deposits of the Leadville Mining District, Colorado." By S. F. Emmons, J. D. Irving and G. F. Loughlin. Pages 55-59.

[3]U. S. Geological Survey Professional Paper 93, "Geology of the Navajo Country." By Herbert E. Gregory. Page 97.

height, known as the "spine of Pelée," which stood for some months before it finally crumbled.

The volcanic explosion pipe has now become a volcanic vent, and the lava solidifying therein after the cessation of eruptive activity will be in the shape of a cylindrical column or "plug," as it is termed, which reproduces the shape of the pipe. It has been thought by some geologists that the general circular or elliptical cross-section of lava-filled volcanic vents has been due to the corrosion and melting, by the lava, of the walls of a fissure by which the lava first gained access to the surface. Although this may be true in some cases, numerous instances can be cited where the volcanic vent is not located on a fissure, but, instead, penetrates unbroken and unfaulted formations; and since, also, there is a direct and unbroken sequence from volcanic explosion pipes containing only breccia, through those containing breccia traversed by dikes, to pipes of similar shape which are wholly occupied by lava, the facts suggest that many if not most volcanic vents of circular or elliptical shape originated as volcanic explosion pipes. A vent of this type is illustrated by the Beacon Hill plug, in the Cripple Creek mining district, Colorado[4], which is a cylindrical column of massive phonolite, elliptical in plan, with major and minor axes of 2,000 and 1,000 ft., respectively, penetrating granite. It is cut by several post-intrusive mineralized fissures of small displacement, but so far as known is not associated with any pre-intrusive fissure of sufficient importance to have served as the original conduit, later enlarged by melting; the survival of a few patches of explosion breccia along the walls of the plug affords direct evidence that it occupies what was originally a volcanic explosion pipe.

Most volcanic activity is intermittent, consisting of a succession of eruptions alternating with intervals of repose, during which the volcanic forces are recuperating. In the periods of dormancy, the lava column occupying the vent tends to become solidified, thus blocking further egress of the magmatic gases, so that gas pressure again accumulates at the top of the fluid portion of the magma below. When it has increased sufficiently, an explosion ensues, shattering the lava plug in the same way that the original pipe was created, and thus reopening the way for a similar cycle of events, as previously recited.[5] In the life of some volcanoes, this may happen many times. The explosive shattering of the plug is the cause of the concussionary earthquakes, by which the resumption of volcanic activity is commonly heralded.

### Pipes Usually in Groups

Volcanic explosion pipes, filled with breccia or with lava or both, usually occur in groups. In some instances, apparently, an old vent becomes so solidly sealed that, with the resumption of magmatic aggression, another vent can be more readily created by the formation of a new explosion pipe in the vicinity. Or, since the sealing of the old vent, the magma may have made its way more closely to the surface somewhere else, so that the relief of gas pressure can more easily be obtained by the formation of a new explosion pipe at this point. In some areas underlain by large intrusive masses, the roof over the intrusive is perforated by many sporadically distributed volcanic explosion pipes, as if by a gigantic charge of buckshot. The multiplicity of pipes in such formations is probably attributable in principal part to the existence of numerous tongues or cupolas of magma extending upward from the main mass—each constituting a local reservoir for the accumulation of gas pressure, which ultimately is relieved by the formation of a volcanic explosion pipe at that point, without affecting the others. The Hopi Buttes volcanic field, in Navajo County, Ariz.,[6] contains a notable group of explosion pipes; and their sporadic distribution lends no support to the views of some geologists, that magmas necessarily attain the surface along important pre-intrusive fissures or lines of crustal deformation.

*(To be continued)*

[4]U. S. Geological Survey Professional Paper No. 54, "Geology and Gold Deposits of the Cripple Creek District, Colorado." By Waldemar Lindgren and Frederick Leslie Ransome. Pages 34-35.

[5]On May 8, 1902, the 30,000 inhabitants of the city of St. Pierre, on the island of Martinique, in the West Indies, were almost instantly annihilated by the scalding heat of magmatic gases—principally steam—which enveloped the city, after being released from the vent of the near-by volcano of Pelée during an explosive eruption of the type described, in which no lava was emitted.

## Cheap Manufacture of Calcium Chloride Should Aid Chloridizing-Leaching Process

IN UTAH many deposits exist of low-grade lead-silver ores amenable to chloridizing roasting and brine leaching. However, soluble sulphates are formed during the chloridizing roasting, which greatly lower the solubility of the lead when the roasted ore is leached with brine. Therefore, the problem is to remove the sulphate radical from the solution during leaching. As a result of experimentation by the Intermountain Experiment Station of the U. S. Bureau of Mines at Salt Lake City, it was found that this radical could be successfully removed by adding calcium chloride to the brine leaching solution, thereby precipitating calcium sulphate. However, as the price of calcium chloride is about $40 a ton, it is not commercially feasible to use this reagent.

It is estimated that calcium chloride could be produced from salt, sulphuric acid, and limestone for approximately $35 a ton, but this cost is also prohibitive. Hence experimentation was undertaken by the Bureau to devise a cheaper method for producing this reagent. As a result, a method has been worked out whereby the calcium chloride can be produced by heating salt, silica, and ferric oxide to 850 deg. C. in the presence of steam. The hydrochloric acid vapors evolved can be fixed as calcium chloride without taking any precautions during the condensation to diminish the amount of moisture. The success of this process depends largely on the mechanical behavior of such a mixture of siliceous material and salt, and on the concentration of the calcium chloride obtained.

Cheap calcium chloride would admit of the application of the chloridizing roasting and brine leaching process not only to low-grade lead-silver ores, but also to blast-furnace flue dust. At present this flue dust is returned to the furnaces, which not only diminishes the useful capacity of the furnace but also reintroduces volatilized impurities.

In connection with the application of the chloridizing process to the treatment of ores, it is possible to form valuable chlorides other than those of the metals, as, for example, potassium chloride. This chloride is of especial value as a fertilizer in connection with the sugar-beet industry.

[6]U. S. Geological Survey Professional Paper 93, "Geology of the Navajo Country." By Herbert E. Gregory.

# *Building a Tailing Dam in a Northern Latitude*

## As Accomplished by the Hollinger Consolidated Gold Mines

CONCLUDING INSTALLMENT

By A. H. HUBBELL
*Associate Editor*

*IN Part I of this article, which oppeared in last week's issue, were described the building of the preliminary dam and the method of distributing or "spilling" tailing as subsequently developed. In this issue the story of the full cycle of operations is completed.*

### MOVING THE LINE

On finishing the work of spilling, it is necessary to move the pipe line, which is filled with pulp, from the inner to the outer edge of the dam to get it out of the way of the electric dragline which is used in building. The procedure is as follows:

As soon as the spill is finished, the holes in the pipe are plugged to force the full flow of pulp through the entire length of the line, which washes out material that has settled out during spilling. Two men with speeder wrenches then proceed to loosen the collars on the pipe. Three or four turns are sufficient. Following them are three gangs of four men each, who take the first three lengths of pipe, one gang to a length, and break them apart with the aid of bars. Each gang stands two and two at opposite ends of its length of pipe and on opposite sides. Working simultaneously, they break the joints, slewing the end of each length until the lengths lie broken, each diagonally across the original line of the pipe and slanting in the direction opposite to that of the adjacent lengths—that is, in a zigzag manner. The next three lengths are then attacked. This procedure is completed until the entire line is broken. Three such gangs can break half a mile of line in 40 min. The pipes, being in short 16-ft. lengths, drain clean and are rolled to the outside edge of the dam. The collars are tightened again without delay to squeeze the slime out of the joints while it is still soft, and are stacked in piles. The design of the coupling used on the 10-in. pipe is shown in Fig. 6.

### RAISING THE DAM

Now the dragline is brought into action. Running on the old bank of the dam, it backs up, scooping up the tailing along the inner edge of the dam and piling it on the old bank behind itself until enough has been added to raise the bank 7 or 8 ft. The new bank is made about 18 ft. wide on top. Inasmuch as 1 ft. is allowed for shrinkage, the bank, when settled, will be 6 or 7 ft. higher than before. At present it is necessary to increase the height of the dam about 6 or 7 ft. a year. The new

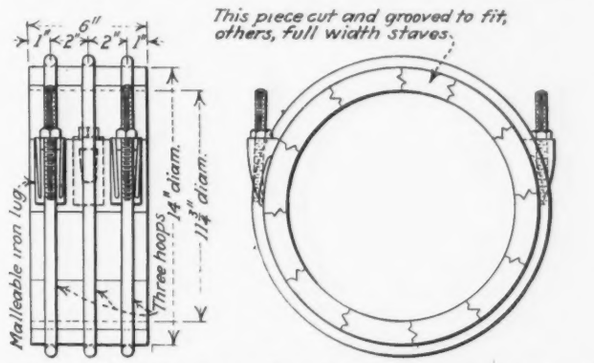



*Fig. 6—Detail of coupling for 10-in. wood-stave pipe used in spilling tailing*

bank is also offset sufficiently to the inside to give a final average slope of about 40 deg. to the outer face of the dam. In the step thus made along the outer edge of the old bank by the offset, the pipe line, broken into its component lengths, rests temporarily until building is completed.

The dragline used is a 20-B Bucyrus electric machine, with caterpillar treads and a ¾-yd. scraper bucket. A power line for its operation is carried around the boundary of the area, at the foot of the dam, with plug-in boxes every 600 ft. When the bank is too soft for the machine to travel on, timber mats are used. Each mat consists of three 12x12-in. timbers 16 ft. long, bolted together. Mats of two 12x12-in. timbers, 28 ft. long, are used when necessary. Mats are moved and placed in position by means of sling chains from the bucket, which hook into short cable loops through them. They are handled by the regular shovel crew, consisting of an operator and one helper.

To permit use of the dragline in the winter, either for building (although this can be done only at considerable expense in freezing weather) or for unloading coal in

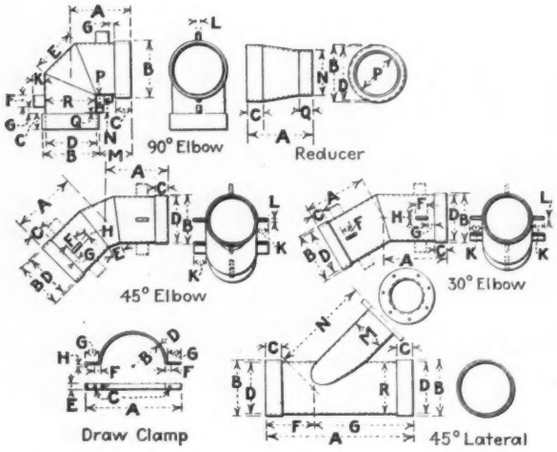



*Fig. 7—Details of iron fittings for wood-stave pipe*

the discharge from each individual spigot flows in its own course to the central settling pool.

### Life of Pipe Depends on Handling

The wood-stave pipe, of both 10-in. and 12-in. sizes, together with the connecting collars, is of British Columbia fir and of the ordinary construction. Its life depends on the handling it receives. Kept full and handled but little it will last indefinitely. Although subject to considerable handling, the pipe will last six years with reasonable care. The collars, which serve as couplings, stand well, and the iron hoops, if oiled at the threads before stacking, have a long life and give very little trouble. Special metal fittings, made in the Hollinger shops, are provided for the pipe line. They are shown in Fig. 7.

The tailing flows to the pump station through two 12-in. wood-stave lines, as previously stated, only one of these being used at a time. So far as friction is concerned, the pulp is run as water. Whether the tailing is diluted or not depends on the tonnage. If this is falling off, water must be added, but not too much. The per cent of solids varies between 40 and 60 per cent; on the average it is 50 per cent. The pipe line delivers to the pump feed box of the pump station at the pond. See Figs. 1 and 2 in Dec. 1 issue (pp. 862, 863).

| Fitting | Dimensions in Inches | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | K | L | M | N | P | Q |
| 14 90° elbow | 15¾ | 15 5/16 | 4 | 14 11/16 | 11 5/16 | 3 | 1½ | ¾ | 3 | 1½ | 9 | 2½ | 1½ | ¾ |
| 12 90° elbow | 14¾ | 13 11/16 | 3½ | 12 5/16 | 10½ | 3 | 1½ | ¾ | 3 | 1½ | 8 | 2½ | 1½ | ¾ |
| 10 90° elbow | 12¾ | 11 11/16 | 3½ | 10 5/16 | 8 11/16 | 3 | 1 | ¾ | 2½ | 1½ | 6 | 2½ | 1½ | ¾ |
| 14 45° elbow | 14 | 15 5/16 | 4 | 14 11/16 | 7½ | 3 | 1½ | ¾ | 2½ | 1½ | .. | .... | .... | ... |
| 12 45° elbow | 12 | 13 11/16 | 3½ | 12 5/16 | 5½ | 3 | 1½ | ¾ | 2½ | 1½ | .. | .... | .... | ... |
| 10 45° elbow | 10 | 11 11/16 | 3½ | 10 5/16 | 4½ | 3 | 1 | ¾ | 2½ | 1½ | .. | .... | .... | ... |
| 14 30° elbow | 14 | 15 5/16 | 4 | 14 11/16 | .... | 3 | 1½ | ¾ | 2½ | 1½ | .. | .... | .... | ... |
| 12 30° elbow | 12 | 13 11/16 | 3½ | 12 5/16 | .... | 3 | 1½ | ¾ | 2½ | 1½ | .. | .... | .... | ... |
| 10 30° elbow | 10 | 11 11/16 | 3½ | 10 5/16 | .... | 3 | 1 | ¾ | 2½ | 1½ | .. | .... | .... | ... |
| 14 45° lateral | 33 | 15 5/16 | 4 | 14 11/16 | .... | 8½ | 24½ | .. | .. | .. | 10 | 20½ | .... | ... |
| 12 45° lateral | 30 | 13 11/16 | 3½ | 12 5/16 | .... | 8 | 22 | .. | .. | .. | 8 | 17½ | .... | ... |
| 10 45° lateral | 25½ | 11 11/16 | 3½ | 10 5/16 | .... | 7½ | 18 | .. | .. | .. | 6 | 14½ | .... | ... |
| 14 to 12 reducer | 19 | 15 5/16 | 4 | 14 11/16 | .... | .. | .... | .. | .. | .. | .. | 13 5/16 | 12 5/16 | 4 |
| 14 to 10 reducer | 17 | 15 5/16 | 4 | 14 11/16 | .... | .. | .... | .. | .. | .. | .. | 11 5/16 | 10 5/16 | 3½ |
| 12 to 10 reducer | 15 | 13 11/16 | 3½ | 12 5/16 | .... | .. | .... | .. | .. | .. | .. | 11 5/16 | 10 5/16 | 3½ |
| 14 draw clamp | 22½ | 8 | 5/16 | ¾ | 1½ | 1¼ | 3½ | ¾ | ¾ | .. | .. | .... | .... | ... |
| 12 draw clamp | 20½ | 7 5/16 | 5/16 | ¾ | 1½ | 1¼ | 3½ | ¾ | ¾ | .. | .. | .... | .... | ... |
| 10 draw clamp | 18½ | 6½ | 5/16 | ¾ | 1½ | 1¼ | 3½ | ¾ | ¾ | .. | .. | .... | .... | ... |

In raising the height of the dam today, the abutments are carried up the hillside without any special footing, simply by piling tailing on the ground. Inasmuch as the advance is no longer over swamp, no pad of sand is needed to support the shovel.

When the dam has been raised to its new height and the bank has settled, the pipe line is moved to its new position on the inner edge. The lengths of pipe are raised from their temporary resting place to the new level by passing a rope around them and "rolling" them up the slope. These lengths must now be joined together. The procedure is to place the collar on the end of the section already assembled, oil the thread of the clamp bolt, slacken the nut about three or four turns, slip the end of a new length into the collar, and tighten up.

When the pipe line is in position, spilling may be resumed whenever it is desired. The excavation of the tailing for raising the height of the bank has left a ditch of corresponding depth and width along the inside of the dam. On resumption of spilling this ditch receives the entire discharge and soon begins to overflow, cutting a channel out at the lowest point. The current created by the flow of water along the ditch carries a large portion of the suspended slimes. As the ditch fills, this flow is gradually reduced till it entirely ceases and

On switching from one line to the other, the first is drained into the spill pond provided for the purpose (Fig. 1). Thus, settling of solids in the pipe is prevented and, in winter, freezing of the line. However, owing to the heat contained in the water as it leaves the mill and the insulating quality of the wood pipe, the line may be shut down for short periods without immediate draining. On one occasion it stood twelve hours, without freezing, in a wind with an outside temperature of 17 deg. F. below. On another occasion with normal flow the temperature of the pulp, on leaving the mill, was 43.7 deg. F.; and at the pump house 40.1 deg. F. The outside temperature was 18 deg. F. below zero.

Equipment at the station includes two No. 8 Wilfley slime pumps, each with its own plug valve and operated by a 100-hp. motor. Eventually a third pump will be provided to serve as a spare while the other two are running. Provision has been made to install larger motors than those in use at present, as tonnage or discharge head may demand.

The pulp enters the feed box of the pumps (Fig. 2), in which the plug valves are situated. These valves, the design of which is shown in Fig. 8, are of a special type developed by the Hollinger engineers. The box is so

constructed that either pump may feed from it, thus affording flexibility of operation.

For the purpose for which it is used, this plug valve is said to be superior to anything else on the market. For one thing it does not stick or leak. The rubber plug is of fairly soft material and cuts off tightly. The seat does not cut out as quickly as do those in other valves, and when it finally goes can be easily renewed at small expense. By means of the hand wheel shown, the valve is turned without gearing and requires only one man for the purpose.

**Table II—Cost of Handling Tailing**

| Item | |
|---|---|
| Mill end | |
| Upkeep on liners and valves | $0.0007 |
| Distribution | |
| Everything at the other end except the electric dragline | .0133 |
| Special filling | .0013 |
| Operation of electric shovel, including all electrical work | .0031 |
| Overflow—clear water pumping | .0011 |
| | $0.0195 |
| Repairing dam due to subsidence of support | .0034 |
| Total | $0.0229 |

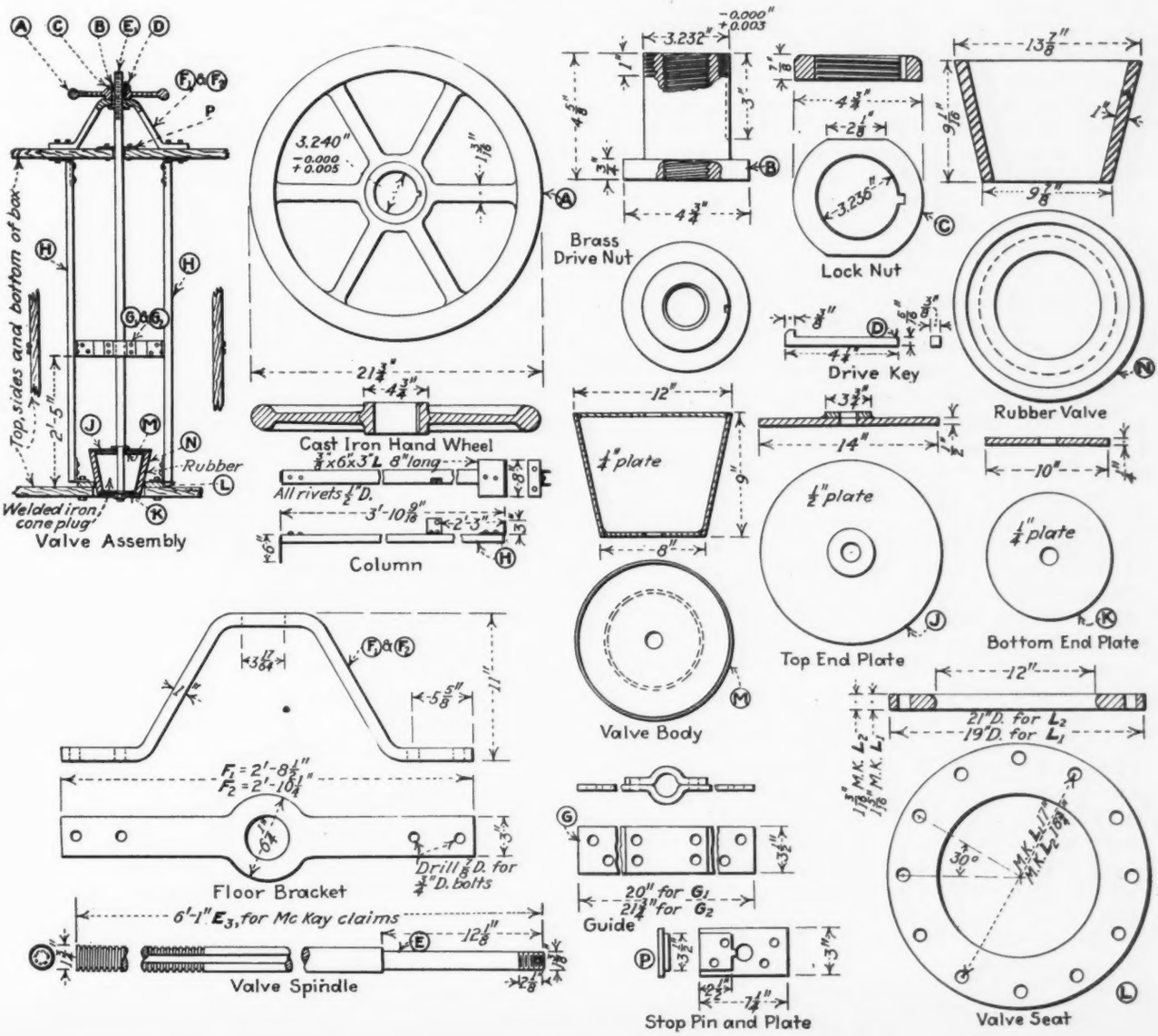
The pump liners are of white iron. As to life of the parts, the runners last one month, casings 65 days, and the follower plates 35 days.

The cost of handling tailing during the twelve-month period ended Dec. 31, 1927, was 2.29c. per ton. This is distributed as shown in table.

Had the company possessed a really suitable dam site, instead of a hitherto untried foundation of muskeg and clay on which to build, the item of $0.0034 in the tabulation of costs would have been avoided. The repairs which it covers were necessitated by the subsidence of the impounded tailings at the southeastern corner of the pond, owing to the yielding of the muskeg and clay support. The latter, under the pressure of the tailing, evidently flowed horizontally to the south underneath the surface. The disturbed condition of the forest a few hundred feet south of the pond bears witness to this end. Despite this, the dam at this point did not sink far enough to permit the water to escape. At no time since the work was started, in fact has subsidence occurred to this extent.

Thus the dam may truthfully be said never to have failed in the three years during which this method of impounding tailing has been in use. As stated previously, the dam has attained a height of 52 ft. at the southwest corner. To what height material of this nature can be carried experience alone will determine.

*Fig. 8—Details of design of plug valve used in pump station*



# *Electric Power In Lake Superior Iron Mining, and Its Influence on Output*

By A. C. BUTTERWORTH
*Electrical Engineer, Mining Department, Pickands, Mather & Company, Duluth, Minn.*

THE use of electric power in the last five years in the iron-mining industry of the Lake Superior region has continued to show an increase which appears to be reflected directly in higher efficiency. In 1922 a group of twelve representative underground mines, nine of which were completely electrified and the others partly electrified, showed a power consumption of slightly less than 4 kw.hr. per ton. In 1927 a similar group of sixteen mines showed a power consumption of slightly over 8 kw.hr. per ton. Although the use of electric power cannot be credited with the entire increase in efficiency, it is interesting to note that, coincident with the foregoing increase in power consumption, the mining efficiency as expressed in tons per man has nearly doubled in the same period.

The uses of electric power in underground mining include the following operations: hoisting (skips and cages), air compressing, pumping, underground and surface haulage, ventilation, "slushing" or scraping dirt, crushing and lighting. In addition, there are surface uses such as shop power, crushers, sample drying ovens and laboratory equipment, miscellaneous surface power and lights, as well as operation of mine-signal systems and a certain amount of electric blasting.

Of these uses the consumption in pumping operations is largely independent of mining work, except as the increased depth of a mine will increase the head and sometimes the amount of water flowing. The consumption in hoisting, assuming normal operation with good equipment, is almost directly a function of the production and depth of hoisting. For 1927 the pumping power for the previously mentioned group of electrically equipped mines amounted to about 40 per cent of the total power consumption; or in other words, for every ton of ore produced, 2½ tons of water was pumped a vertical distance of 1,000 ft. The sum of the hoisting and pumping power amounted to about 50 per cent of the total power. The work performed by these two operations is not subject to variations except as to production, depth, and amount of water, and would normally have no effect on mining efficiency. It is in the intelligent use of electricity elsewhere that mining efficiency can be increased.

Abstract from a paper presented at a meeting of the A.S.M.E., Aug. 27-30, 1928.

The power used in compressing air is, next to pumping, the largest single item in this list and amounts to about 35 per cent of the total power. Compressing air by electricity is one of the most expensive ways of using power unless constant attention is paid to the matter of leaks, proper size of air lines, and the question of overtime operation. For individual mines the power consumption per ton varies from about 1.5 kw.hr. to about 10 kw.hr., depending on the extent of the air-distribution system, the number of hours during the month in which the compressor is running, the condition of underground ventilation, the type of mining equipment and method of mining being used, and to a certain degree the character of the material mined. Adequate air pressure at the working places underground is a prime requisite for satisfactory mining efficiency, and no effort should be spared to make this condition possible. However, it is frequently found that increased compressor capacity increases power costs, owing to additional use and waste of air without a corresponding increase in efficiency; and the tendency now is to reduce the use of air as much as possible by substituting other methods of operation.

More and more attention is being paid to the mechanical ventilation of the mines. In the early days many mines had reasonably good natural ventilation, but with the increased depth of mining even those mines are now turning to mechanical ventilation. Many devices have been tried out to improve local ventilation in exceptionally poor places. Direct blowing of compressed air and the use of air "injectors" and air-operated fans and blowers have generally given way to the use of the latest type of portable motor-driven ventilating fans. The trend of this work, however, is toward the large mine-ventilating unit, together with a proper system of air doors throughout the mine, to give adequate and positive ventilation everywhere. At some mines it is found necessary to operate these big fans only occasionally, but sometimes conditions make it necessary to run them continuously; and, without question, considerably more power can be used to good advantage for this purpose in most underground mines in this territory. Although no comparative figures are available, it stands to reason that fresh air will keep the mining efficiency higher than if the air were hot and "dead," as is frequently the con-

dition at present. At one property operated by Pickands, Mather & Company, where the fan is used continuously, the power consumption is about 1 kw.hr. per ton; and, as expressed by the underground men, "this fan is worth a million dollars."

Probably the factor of greatest importance in the last six years in increasing mining efficiency has been the development of the slushing hoist and its adaptation to the problems of mining. Almost all underground mines have slushing hoists operated by air engines or electric motors. Several double-drum hoists are in operation, driven by 25-hp. motors, and capable of handling scrapers more than 4 ft. wide, at a rope speed of approximately 300 ft. per minute. Such an outfit with two-man crews working on eight-hour shifts recently mined and scraped into the loading chute more than 1,000 tons of ore in one 24-hour period, and for the entire month in which this record was made this one machine was credited with about one-third of the total production from this mine. Several hoists of this size and slightly larger are in use in the open stopes or in handling material to transfer raises in several of the mines, but the largest part of the tonnage from slushers is produced with smaller outfits of from 6½- to 10-hp. capacity, handling scrapers from 24 to 36 in. wide. Most of the electric slushing hoists are equipped with 250-volt direct-current motors, and in the smaller sizes are thrown directly across the line in starting. Several scattered hoists are equipped with alternating-current motors, either 220 or 440 volts, and the Oliver Iron Mining Company has laid out and is equipping its Godfrey mine, one of the large underground mines on the Mesabi range, for 440-volt alternating-current slusher operation throughout.

The use of electricity for lighting underground has not been expanded to its logical limits. Notwithstanding several exceptions, the majority of mines are not illuminated to the degree that is economically feasible. Although no direct comparisons are possible, there is a growing feeling that underground illumination can be very materially increased, to the advantage of mining efficiency, and that it will also assist in reducing accidents underground. At one underground mine the power consumption for lighting amounts to over 1 kw.hr. per ton, and this expenditure is considered a good investment. At another mine recently a light at a raise was credited with saving the lives of two men caught in a blasting accident.

It seems as though there might be a continued growth in the use of electric power in underground mines up to at least 12 kw.-hr. per ton of production, or 50 per cent more than at present. The figures given have been worked up from the records of mines operated by Pickands, Mather & Company, and it is believed that they are fairly representative of average conditions which obtain throughout the Lake Superior district.

### Electric Power in Open-Pit Mining

The larger part of the annual tonnage of iron ore comes from the open-pit mines on the Mesabi range, and the use of power in these open-pit mines presents different problems. A few of the recent stripping jobs have been done partly by electric power, either with electric shovels or drag lines, or by hydraulic sluicing. In almost all operations, however, the haulage is by steam locomotives.

The use of electric power for shovel operation in the regular production of ore is becoming more and more general, although it will probably be a long time before the steam shovel will become obsolete on the Mesabi range. Electric shovels in operation range in size from the small 1¾-cu.yd. revolving shovel up to the 350-ton revolving shovel on trucks, using a 10-yard dipper. Some of the earlier shovels are equipped with alternating-current motors, but the latest ones use a synchronous or induction motor-generator set, with direct-current motors and Ward Leonard control.

The first open-pit mine to be completely electrified on the Mesabi range, and up to the present the only operating mine on this range so equipped, was the Wabigon mine, at Buhl, Minn., operated by M. A. Hanna & Company, which was electrified in 1924. The new Missabe Chief mine, at Keewatin, Minn., operated by the same organization, is also now being equipped for complete electric operation. Haulage at both of these mines is by means of trolley-type electric locomotives weighing about 60 tons and operating on 600 volts direct current.

The Volunteer mine, at Palmer, Mich., operated by Pickands, Mather & Company, which shipped its first ore in 1926, is at present the only other open-pit mine in the Lake Superior district operated entirely by electric power. The haulage at this mine is by means of the "Woodford system," which has been used at a number of places in quarry work, but never before in open-pit iron mining. In this system each car is equipped with motors operated on 250 volts direct current and running on standard-gage tracks with a third rail. The third rail is sectionalized and energized by feeder cables from a central control tower situated where the tower man can have a good view of the pit. The cars are equipped with selector switches, so that the operator can apply power or brakes in varying degrees by changing the voltage on each section of track. They are also equipped for dynamic braking when going downgrade, so that even if power should fail, the cars are automatically limited to a safe maximum speed. At reversing points along the track, track cams are installed which throw over the reversing-switch equipment on each car as it comes along, thus obtaining the proper direction and sequence of operations. At this particular mine all the ore goes through crushers, and there is no occasion for the regular railroad cars to go into the pit. If such were not the condition, this particular type of haulage could not have been used. With this system the only haulage operating labor consists of one man in the central control tower, one man on the shovel for spotting cars for loading, and one man in the crushing plant for spotting and dumping the loads, as made available, into the crusher.

Present consumption of electric power in open-pit mining, which amounts to about 1½ kw.-hr. per ton, is largely used in pit drainage and the operation of electric shovels and plants for beneficiation of ore, with the occasional use of motor-driven compressors for furnishing air for drilling in the pit. Most of the drilling is done by churn drills, and the power consumption per ton is relatively light. Power is also used for the operation of shops, for lighting locations and mine buildings, for the operation of laboratory equipment, and for other miscellaneous purposes. Considering the possibilities of complete electrification of haulage and digging operations and the probable increase in concentrating plants,

a reasonable outside figure for the use of power in open-pit mining could be stated as approximately 5 kw.-hr. per ton.

Iron mining is essentially a destructive game. For this reason, the point of view of the miner who is handling electrical equipment is necessarily different from that of a man who may be engaged in building up rather than tearing down. It should be evident, therefore, that electrical equipment used in mining and all control equipment handled by the producing labor at the mines should be as sturdy, compact, simple, and as foolproof as possible. It is easy enough to sit in an office and say that the men should use a reasonable amount of care and common sense in handling such equipment, but the fact remains that this equipment is provided to enable the men to get out the material mined; and if it is complicated, or hard to handle, or cannot stand rough and heavy service, frequently under extremely wet and dirty conditions, the equipment is not suitable and does not remain long in service. Equipment that is satisfactory for ordinary industrial use is frequently entirely unsuited for mine purposes, and the present tendency is toward the development of an exceptionally sturdy line of equipment, with control apparatus as simple as possible. The success of further extensions in the use of electric power, either to increase the mining efficiency or to decrease operating hazards, will depend to a considerable extent on whether satisfactory equipment can be provided and operated at a cost which will let it compete with present methods of mining.

# *Underground Haulage at the United Verde Mine*

By E. W. FREDELL

*Chief Electrician,*
*United Verde Copper Company,*
*Jerome, Ariz.*

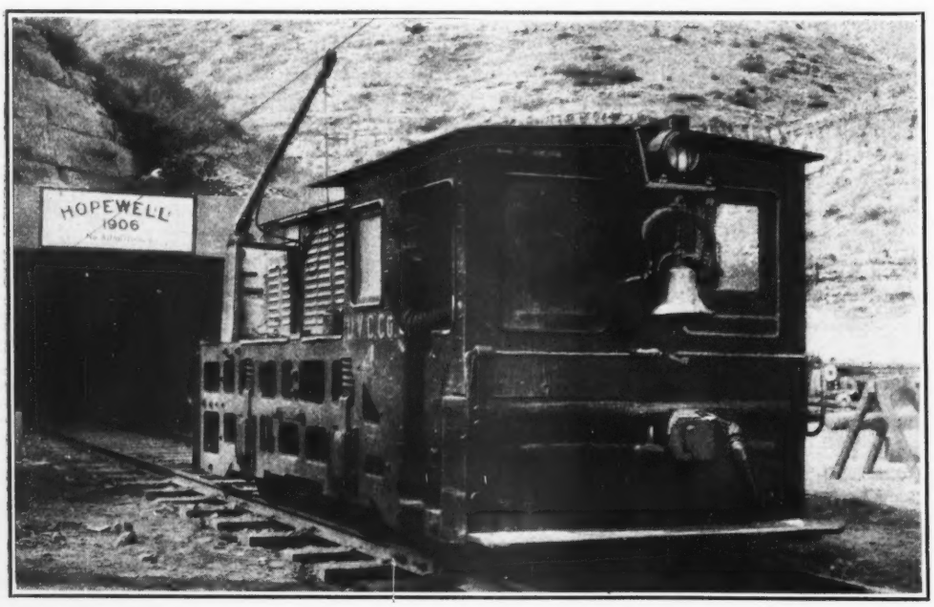
AFTER the mining of the ore comes the problem of getting it to the surface with a minimum of expense. One of the large items of cost in this operation is haulage. At the United Verde the haulage system has been worked out according to the following plan:

### MAIN ORE HAULAGE

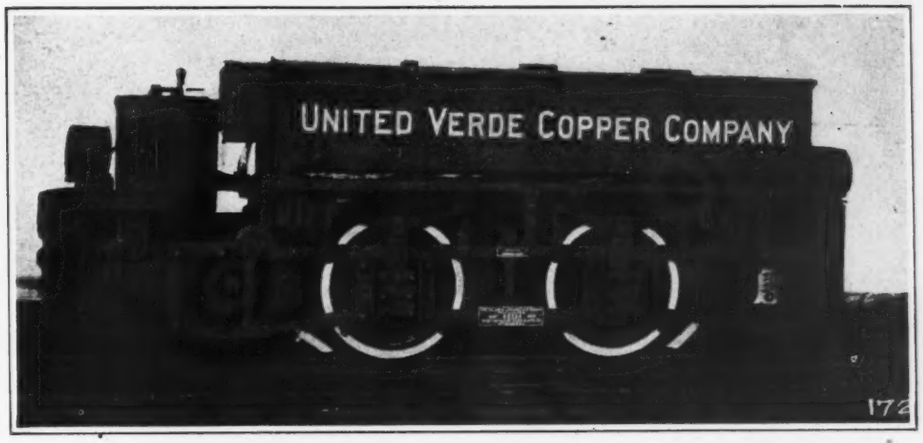
All of the ore production, whether hoisted from the levels below or passed through raises from the levels above, is assembled in eight storage bins located on the 1,000 level. From these bins an adit, 8,500 ft. long, leads to the surface ore bins, making a total haul of 9,500 ft. on this line. The track is standard gage, with 75-lb. rail and a grade of one-half of 1 per cent in favor of the loaded trains. A train consists of nine 20-ton cars of 40 tons' capacity each, making a total trailing load of 540 tons.

Owing to the long haul and the heavy loads handled, 25-ton trolley locomotives were chosen; one of these, a Baldwin-Westinghouse, is shown in the illustration. Four locomotives are in use on this level, and when pushed to the limit, work in eight-hour relays. The relay operation of locomotives provides spare locomotives for emergencies and insures economical maintenance. These locomotives have pneumatic control, and are equipped with 50-cu.ft. capacity compressors to enable them to handle train-line air as well as the straight air on the locomotive.

The Arizona state law provides that all underground




*A 25-ton locomotive used for haulage in the 1,000-level adit*




*A five-ton Baldwin-Westinghouse battery-type mine locomotive as used by United Verde*

men shall work eight hours from collar to collar—that is, the men go down and come up from the mine on company time. As the adit on the 500 level is 2,100 ft. long and all the men cannot be handled on one cage load, the company hauls the men to the shaft in so-called "Pullman" trains. Two trains are used, making three trips each at shift time. Ten-ton standard-gage trolley locomotives, equipped with manual control and straight air on locomotives, are used on this run. The track is 75-lb. rail, and the grade is one-half of 1 per cent against ingoing loads.

The shops are on this level also, so all timber, steel, and miscellaneous supplies are handled through the same adit. As the mine track gage on the various levels is 18 in., track of this gage was consolidated with the standard gage.

The inconvenience of trolley wire above the yard tracks, as well as around the shops, was the determining factor in choosing a storage-battery locomotive for the supply service. A five-ton storage-battery locomotive, equipped with two batteries, is in use at present. The second battery enables the locomotive to be kept in continuous service.

### Ore Handling on Various Levels

On all levels in the mine the track gage is 18 in., and the hauls vary from 600 to 1,300 ft. The cars in use in the newer part of the mine are 30-cu.ft. rocker-bottom with roller-bearing wheels. Sixteen loaded cars constitute a train. In the older parts of the mine, side-dump cars of 18 cu.ft. capacity, with roller-bearing wheels, are used. Eighteen to twenty of these cars are the customary number in a train.

On all levels except those opened up within the last six years, trolley haulage is used. The locomotives are of two sizes—namely, the four-ton and the six-ton. Eighteen trolley locomotives are in use. On all the newer levels, battery locomotives are used. These also are of two sizes, three and one-half and five-ton locomotives. Battery locomotives are handling the majority of the levels that are on heavy production of ore, as well as those that are in the development stage. Fourteen of these locomotives are in use at present, and more will be used in the future. Two batteries are used with each locomotive, and charging stations are on each level, allowing for twenty-four service. Maximum tonnage now available, with two locomotives working two shifts, is about 1,000 tons over a 1,000-ft. haul.

The policy of this company is to expand its storage-battery operations and curtail the trolley locomotive operations. The principal advantages found for storage-battery locomotive operation may be recorded as follows:

1. Elimination of fire hazard from trolleys.
2. Elimination of trolley hazard for men loading ore at chutes and in the drifts.
3. Lower maintenance costs.
4. Convenience in having haulage at any point to which tracks are laid.

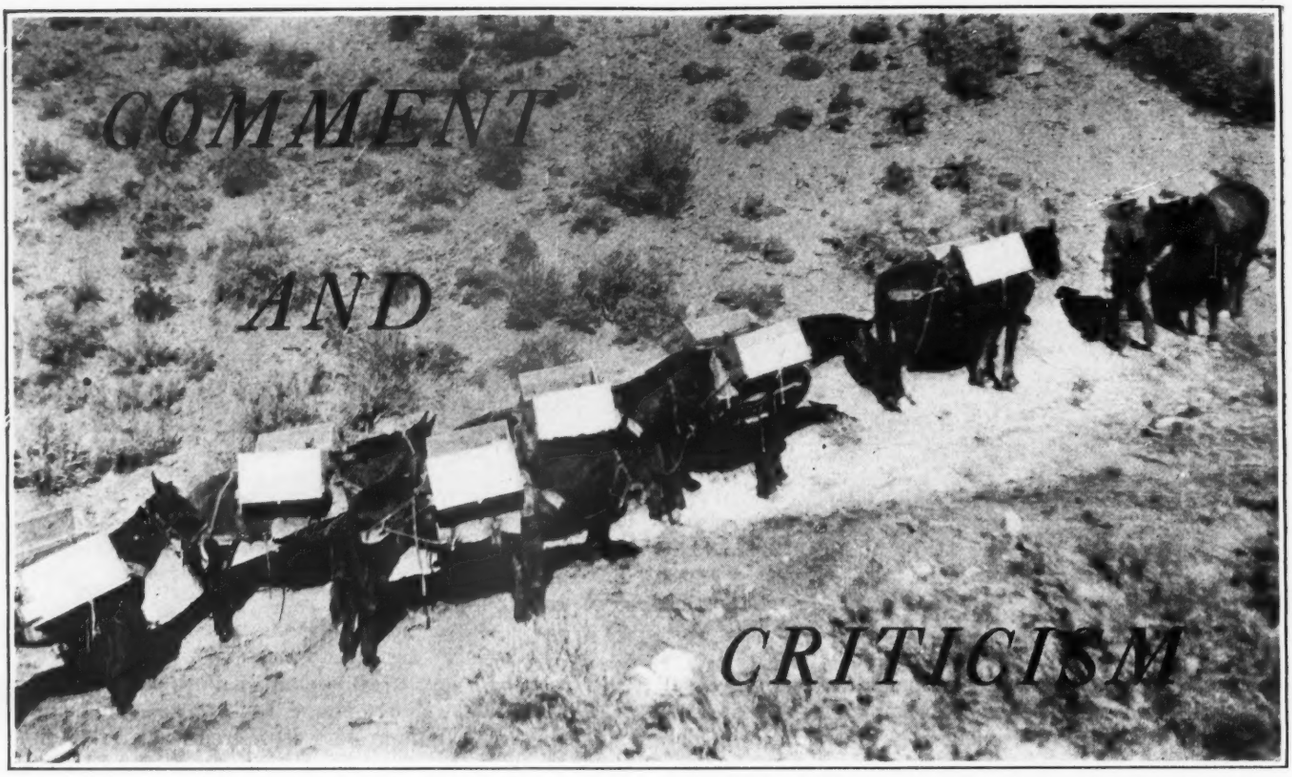
Track conditions are maintained much better than in the usual mine. Forty-pound rail is used, and curves are kept to a minimum of a 30-ft. radius. Maintaining good track is the secret of getting out a heavy tonnage with a minimum of abuse to the equipment.

## Rhodochrosite and Quartz Separated by Flotation

LABORATORY work on the beneficiation of manganese ores at the Mississippi Valley Experiment Station of the U. S. Bureau of Mines has brought out some facts of interest to the metallurgist. On rhodochrosite samples from the Butte district, flotation, gravity concentration, and magnetic separation processes have been tried. Flotation is very promising. With it good separations have been made between rhodochrosite and quartz. Sulphides in the ore can be floated with the usual reagents, xanthate, copper sulphate, and pine oil. Results indicate that these reagents have no deleterious effect on subsequent flotation of rhodochrosite by use of sodium oleate. Gravity concentration may be employed to reject about half the silica in the ore so that a better grade may be ground for flotation. If a part of the silica could be removed by gravity concentration before grinding to flotation size, cost of grinding would be reduced and enriched flotation feed thus obtained would be more amenable to cleaning. An electromagnet may be used to remove the rhodochrosite from the quartz. Further details will be given in a report soon to be issued by the Bureau.

## A Picture of Grinding Efficiency

**DOES a screen analysis mean anything to you? Would it mean more if you could have the data in the form of a chart, with the average diameter of the particles in the feed and discharge of a mill plainly shown? Mr. W. H. Coghill has worked out a method, which will be explained in detail in next week's issue.**




# More About the Porcupine Paymaster

## *Cost of Erecting and Equipping New Concentrator Was Low, According to H. E. Clement—Other Details*

*To the Editor of "E.&M.J.":*

It may be of interest to add a few details to your excellent articles describing the Porcupine Paymaster enterprise, which appeared in your issues of Nov. 10 and 17.

A modification of the described method of opening the stopes, which was being considered for the "E" porphyry body, would be to locate the main haulage drift close to the footwall, but still in the ore, and to carry the pillar raises also near the footwall. From these pillar raises, the sublevel crosscuts would be driven to the hanging wall at the usual 33⅓ ft. intervals, giving seven of these to develop each two stopes if a 300-ft. lift were taken, and with short drifts right and left from the crosscuts through the pillar at convenient intervals. Crosscuts from the main haulage drift would be driven to the grizzly chutes.

The advantages of this modification would be that stopes below could be extended to take out the cones above the haulage level without destroying the main haulage drift, by leaving a slice of the ore on the footwall to protect it; the stopes could be entered at frequent side intervals, giving less travel on the end benches of the stope and adding somewhat to safety; and when stoping is completed on each side of the pillar, it could be drilled from the sublevel crosscuts and completely broken out in retreating, giving nearly complete extraction of these pillars. The disadvantages would be the cost of the extra length of stope preparation work on the sublevels that would require shoveling and tramming, about 1,400 lin.ft., to open two stopes, compared to about 350 ft. in the method described; the greater length of time required to open up stopes ready for extraction; and some weakening of the pillar, although this would not be serious.

Another modification for use in narrower deposits, or where there might be more danger of flaking from the walls, would be to open up the central slot as described in the article, then to slot across from footwall to hanging wall at the end of the stope next to the blank pillar, and bench back in retreat toward the raise pillar. If it seemed advisable, short pillars extending from one sublevel to the one above, and bridging the longitudinal central slot, could be left at intervals and taken out when the retreating work encountered them. This would add to safety without defeating the purpose of the general method, which is to deliver to the grizzlies the greatest possible tonnage without shoveling.

It was expected that the figure given in the article as the value of the ore could be attained. There had been an undue proportion of ore from development work, and ore obtained from small openings such as drifts and crosscuts had run lower than the ore from stoping; this was to have been expected, as the enriched pyrite concentrations and free gold "plums" comprise only a fraction of the total volume, yet must be included by more extensive work to obtain the true average.

Sampling conducted throughout the first calendar year period had given an average of $2.55 a ton, of which the average from the stopes was $2.70. Naturally, the tailing loss during that period was higher than was obtained later, when for long periods it was under 25c. a ton. However, all official estimates of results to be expected from operation, after the first mill runs were made, have been based on a bullion recovery of $2 a ton, leaving porphyry values over that figure, and the "sweetening" from the expected product of the veins in the schist areas, to increase the operating revenue. The government mint returns from bullion shipped, taken from the published semi-annual reports of the Ontario Department of Mines after deducting the returns for June of this year, as made public by the company, when the concentrator troubles mentioned in the article and the milling of lower-grade ore decreased the returns, averaged $2.230 a ton from the inception of milling April 24, 1926, to June 1, 1928, a period of 25 months. This was after all losses in milling, and in refining at the mine and the mint, had been taken off. During this period two units of the cyanide plant were placed in operation at separate times, and a surface dump that had become diluted with barren schist from development in waste was milled. The average mint

returns for the first five months of this year was $2.292 a ton. Estimated costs, which had been worked out with great care and tested against actual results, allowing for economies due to concentration, larger tonnage, and completion of plant, were: Mining, 60c.; milling and refining, 50c.; general expense and overhead not included in the foregoing figures, 15c. The development cost can be kept very low, for the reasons that it is mainly in ore, that no known orebodies either in porphyry or in the schist are more than 1,500 ft. from the main shaft, and that for a long time the production would be from above the 600 level.

I initiated a policy at the beginning of operations that I believe should more often be carried out in projects where there is so considerable an element of risk as may be inherent to the development of low-grade mines. That policy is: to make every effort to reduce the capital expenditures for plant and equipment to a minimum consistent with efficiency and low maintenance costs. To this end, we developed somewhat specialized types of mill and housing construction, and purchased used equipment in first-class condition rather extensively, after expert detailed inspection. As an instance of this, twelve carloads of crushing and milling machinery were brought from the Comstock Merger mill, then being dismantled, in Nevada, on a special freight rate specially made for this shipment. This equipment was modern and had been given unusually careful treatment. There was a consequent saving to us of nearly 45 per cent on the cost of new equipment laid down, and the heavy first-year depreciation had already been absorbed; and I may say that more difficulties were experienced with new machinery than with this and other used equipment. However, much of the plant was new, such as ball-mill classifiers, agitators, filters, tanks, pumps, all motors and control, machinery drives, and handling equipment. Naturally, there is grave danger of increasing operating and maintenance expenses by installing used equipment, but the avoidance of this danger is a mechanical engineering problem that can be readily solved.

As a consequence of this policy, the cyanide mill, with its complete crushing plant and refinery, cost a little over $500 per ton daily capacity, this being figured at 350 tons, although at times it has treated 400 tons a day. The concentrator building was erected to hold four units, and the bin and dewatering sections will handle their production; two of these were completed and the third required only the ball-mill drive and feeder, concrete floors and launders, and erection of tables. To bring the enlarged crushing plant to its rated capacity of 2,000 tons required at the time of my leaving only the roll close-circuiting screens, and the completion of work of erecting the underground crusher which is now in use. If the cost up to that time be taken, and further expenditure necessary to complete it be added, the crushing and concentrating plants as described will have cost less than $150 a ton daily capacity. This would include all designing and construction overhead charges. The combined cost of crushing, concentrating, cyaniding, and refining installation complete would be about $250 per ton daily capacity. Accepted costs for all-sliming cyanide plants in northern Ontario are from $800 to $1,100 per ton daily capacity. This indicates one advantage of concentration before cyanidation as advocated in your recent editorials; and this is no reflection on current practice in Ontario gold mills, since there is probably no other ore now being mined in the province that is so simple to treat as that of the Paymaster. A comparison of the construction costs given, with those for similar plants using new equipment and the usual types of construction, it being taken into account that the location is in a climate of rather extreme cold weather and long winters and that the plants were each constructed between October and May, will, I think, demonstrate that the policy adopted has resulted in a distinct reduction in amount of capital risked, and of depreciation to be charged against operations.

A feature of the plant design is the arrangement of the different departments as nearly on one level as possible, minimizing the stair climbing and travel necessary for inspection, thus decreasing the labor cost, and by eliminating the crowding of floors, stairways, and runways between the ground floor and the roof, reducing the construction cost and greatly decreasing the fire risk.

Two men on each of two shifts in the crushing plant, two men on each of three shifts in the cyanide mill, with a superintendent, refinery man, mechanic, and helper on one shift, a total of thirteen men per day, handled the complete plant prior to starting the concentrator. Although not in steady operation, owing to the difficulties that were being ironed out, the operating crew in the concentrator consisted of one man per shift on the ball mills and classifiers, and one man per shift on the tables and dewatering section, with mechanics and helpers as required. It was anticipated that not more than 26 men would be required to handle 1,700 tons per day in the complete crushing, concentrating, cyaniding, and refining plants. The simplicity, compactness, and arrangement of the plants, and the uniformity and ease of treatment of the ore, would permit this reduction from the number usually required to handle this tonnage.

From our experience, I suggest that if a thin-board insulation be used to cover buildings where there is possibility of interior condensation, a waterproof paper be used on each side of the insulating board, instead of the pulp paper on the inside that we used, to prevent moisture, in corners or other places where the air moves very slowly, from passing through openings between the sheathing boards and soaking the insulation, the paper being so put on that the laps shed the water away from the insulation. If moist air cannot come in contact with the material it will remain dry and fully efficient.

In the flow sheet, Fig. 1, page 786, the notation "70 per cent minus 200 mesh" should have been placed under the overflow from the Dorr classifier, not under the overflow from the thickener. It may also be noted that the 4-in. upper fitting in Fig. 3 on the same page, as installed, was a long-sweep Y to give less friction to the flow of water.

HARRISON E. CLEMENT.

*Toronto, Ontario.*

## *Investment Losses Result from Fraud or Incompetency*

*To the Editor of "E. & M. J.":*

Two expressions used commonly by mining promoters seem to raise resentment in the minds of the engineer. The first is: "It is a good stock proposition." The second is: "We are giving the investor a run for his money." Just what those two expressions mean is never clearly explained to the investor.

When I have been approached with such a statement I have frequently asked the promoter to explain just what he means. Stripped down to a few words, I find that a "good stock proposition" means that it is good for the other fellow's money, but not for your own. The professional confidence man, or the man engaged in running a shell game at a circus, would call it a "come-on" proposition.

Frequently, the promoter, trying to dispose of a "good stock proposition," means that it is located close to some big mine where it will look well upon a map, or he may mean that it has a narrow stringer of ore from which specimens can be taken that will excite the cupidity of stock buyers, but I never heard of any one making such a statement of a property where ample tonnage was assured to make a profit from ore taken from the ground.

Recently a promotion that has been fathered by two highly respected gentlemen has reached a stage of development where there is a good showing of commercial ore. One of these men was a laundry man in the Middle West and the other was a tobacco salesman in the eastern part of the United States. Neither of them can be considered as competent technical mining operators, although they had put in several thousand dollars of their own money and several thousand dollars that they raised among friends in their former home towns.

The mine is operated with a 25-hp. gasoline engine, and a belt-driven 10x10-in. compressor. The maximum depth of the shaft is 200 ft. These two gentlemen approached me recently with the inquiry: "Do you know where you could get $50,000? We are now ready for a mill."

I replied, "Yes, I know where I can get $50,000. Can't you go and get it

yourself?" After a negative reply and considerable explaining as to the reason why they couldn't raise the money themselves, I called their attention to the fact that if I got it or they got it, it was for the same property, and I insisted on their explaining to me why the investor or capitalist wouldn't hand his money over to them as readily as he would hand it over to me if the money was to be used in the same place.

I then asked them if they wanted me to go to my clients, who had confidence in me, and ask them for their money and then if they expected me to turn the money over to them. I asked them how long they thought I could retain the confidence of my clients by taking money and handing it to people to whom the capitalists would not hand it directly, themselves.

I pointed out to them that the reason that the capitalists would not invest in their mine was because they lacked confidence in the management, and yet they wanted me to get the money and turn it over to them, which I declined to do.

In the first place, the mine wasn't ready for a mill. It had a good showing, but it would be another one of the typical "hand-to-mouth" mining companies. There was nothing ahead of the mill to keep it going while the superintendent was developing more ore or hunting for more ore. If the ore suddenly was cut off, the mill would shut down in ten days.

These two men were honest. They actually hoped for and intended to make a mine if it was possible to do so, but they didn't know how.

I called their attention to another mine that had four years' supply of ore blocked out ahead of the mill, of which the superintendent wasn't touching a pound. I showed them that if the ore should happen to be cut off by a fault, or for some other reason the veins pinched out, the superintendent could keep his mill going for four years, during which time he could hunt for more ore. I explained to these people that it was a very precarious investment to build a mill upon a mine that was depending on a "hand-to-mouth" existence, and that I couldn't recommend any such investment, but that $50,000 in development of tonnage would be a much better and safer disposition of the funds.

The other statement of giving the investor "a run for his money" is rather ambiguous. The promoter who makes that statement figures that if the promoters spend upon the property a reasonable percentage of the money invested by the stock buyer, they are giving the stockholder "a run for his money." It makes no difference to the promoter whether this be spent in a barren hillside or upon a property with no showing at all, or whether or not the sum of money so spent is sufficient to accomplish any beneficent purpose. Just so long as some of it is expended upon a property, he calls it "giving the stockholder a run for his money." As a matter of fact, the stockholder often never has a chance to get a dollar back in any such proposition. If such a prospect has a valuable orebody the promoter doesn't use that statement at all. He then says that we must lease it, develop it, or work it to make it pay.

It is a perfectly safe rule for an investor to start running when a promoter says "It's a good stock proposition," or he'll "give you a run for your money," and it's a thousand to one bet that the investor never will see a dollar back from any investment made in a property promoted with these two statements.

If a property is worth development, the promoter would ask for money to develop it and not merely to give the stockholder a run for his money. If it is a good proposition to mine and operate as a mine, a promoter never would say "It's a good stock proposition."

When both of these statements can be eliminated entirely from the English language, the mining industry will be greatly benefited. LETSON BALLIET.

*Tonopah, Nev.*

## *Selecting a Satisfactory Screen Series*

*To the Editor of "E.&M.J.":*

You attack the I.M.M. testing screens in the issue of Nov. 3. Evidence can be adduced to show that for every ten disadvantages of the I.M.M. series there are at least eleven in the Tyler series. Provided there are enough subdivisions, the actual standard particle sizes and the step from one size to the next do not greatly matter. It is important to designate the standard screen according to the size of particle that can pass through. The designation should be in whole numbers—say, the diameter of the particle expressed in thousandths of an inch.

A British Engineering Standard Association committee is now engaged in drawing up a series of standard screens for all purposes, and the Tyler series is being passed in review.

Had there been nothing to recommend the I.M.M. series it would have died out long ago. As it is, the series is widely used. It is possible that it has now served its day, and I think it will be found that the Institution of Mining and Metallurgy is ready to welcome any screen series produced by the Standard Association.

HUMPHREY M. MORGANS.

*London, England.*

[*Engineering and Mining Journal* is glad to publish Mr. Morgans' comments. The editorial in question, however, deplored an adherence to the I.M.M. series, rather than a recognition of the favorable features of the Tyler series, without open discussion. Mr. Morgans claims that "Evidence can be adduced to show that for every ten disadvantages of the I.M.M. there are at least eleven in the Tyler series." This evidence will doubtless be reviewed by the Engineering Standard Association mentioned, and we hope to abstract from the statement criticized, "that the conference will not be held in secret session, and that those who have contributed so constructively to the literature of the subject, and to the development of screen series in the United States, will have an opportunity to benefit from the arguments advanced and the decision reached."—EDITOR.]

## *Expect a Report on Twigging the Affinities*

*To the Editor of "E. & M. J.":*

Noting in your last issue (Nov. 10) Mr. Robinson's claims as to the merits of the divining rod, I am writing him for more details. The party I referred to in my last letter as offering some field tests with this simple forked twig in discovering water, is, I find, still ready to do his part if we can arrange for it before Dec. 1, and, as I am deeply interested to have fact and fiction clearly demarked by this the simplest of tests, I may send you shortly a notice of the time, place, and conditions of some such field demonstration as I suggested in my former letter.

If there really is in nature such a thing as a "special attraction between like substances," which can be so readily detected, one can readily imagine wide possibilities for the scientific application of such a principle, and not alone to the advantage of mining.

It may be a little difficult to persuade scientific experts to consider attending such a demonstration, and even more difficult to induce any who might attend to serve as umpires, and, if the test is successful, to say so, in print, over their signatures! Great is the prejudice against everything of this sort.

At all events, it will be interesting to note what reaction a notice of such a demonstration would produce in your excellent journal. A. B. BIBBINS.

*Baltimore, Md.*

## *The Enzlin-Eklund Process*

*To the Editor of "E.&M.J.":*

I have read your description of "The Enzlin-Eklund Platinum-Gold Amalgamation Process" appearing in the issue of *E.&M.J.* of Oct. 20; also the request for information by John L. Campbell.

Dr. R. E. Lyons, of Bloomington, Ill., has two U. S. patents covering the above-mentioned process, No. 1,118,944 of Dec. 1, 1914, and No. 1,126,646 of Jan. 26, 1915. Dr. Lyons also has several foreign patents. Mechanical apparatus has been developed and proven for the application of this process on a commercial basis.

I have done much research work on the problem of detection and recovery of native platinum metals in lode ores in this country, but at this time am not at liberty to give this information to the public. WALTER B. COLE.

*Ogden, Utah.*

# By the Way

## Geophysics Outdone

GEOPHYSICAL prospecting must look to its laurels. A North Dakota farmer, one John Dahlgren, personally emanates magnetic waves that transmit to him the pull of oil pools and orebodies, even though hundreds of miles may intervene between the sending-receiving set of his body and the pool or deposit. This startling news is presented on the front page of a recent issue of *Western Mineral Survey* (Salt Lake City), from which it is preferable to quote below, so that none of the details of the technique employed by Mr. Dahlgren may be lost to the reader:

"John Dahlgren, North Dakota farmer, who is creating a sensation in the oil and mining world by his 'magnetic pull' method of locating oil pools and orebodies, declares that the greatest oil pool he has ever 'felt the pull of' lies in the district in which the Leonora company is now driving a test well. . . .

"Already, it is learned, Alois P. Swoboda has acquired a large block of stock of the Leonora company, and it is reported that he has also closed the deal for a lease on Leonora ground in the section where, Dahlgren declares, lies the greatest oil pool in the West.

"Preparations are under way to send the drills down to find the great oil pool. Without any one, outside of a limited circle, having any knowledge of what was going on, the stock of Leonora company shot up on the local mining exchange Tuesday, and it is predicted by those in a position to know that it will go still higher very soon.

"If the 'magnetic pull' which Dahlgren says he received from the Leonora district proves to indicate what he says it does, then Utah is on the verge of becoming an important unit in the oil producing areas of the country. . . .

"Dahlgren was riding with Mr. Swoboda over the short line from Montana to Utah when the New Yorker came here recently. Shortly after they left Pocatello, Idaho, said Mr. Swoboda, Dahlgren remarked that he felt the pull of a great oil pool. Asked to point the direction, he pointed toward Utah.

"'I did not know that there was supposed to be any oil in this section of Utah,' said Mr. Swoboda, 'and knew nothing about any efforts to locate oil there until the other day.'

"However, when Mr. Swoboda and his Dakota farmer reached Salt Lake the latter insisted that the oil 'pull' was stronger. Mr. Swoboda set about locating the source of the pull.

"A few days ago an official of the Leonora company called on Mr. Swoboda and asked him to go out and see the Leonora test well. . . . Mr. Swoboda took Dahlgren with him and went to the Leonora oil holdings north of Great Salt Lake.

"Dahlgren walked over the ground. At a certain location, the North Dakota farmer stopped. Then, using the words of the famous Mormon leader, Brigham Young, when he stood at the mouth of Emigration canyon and surveyed the valley of the Great Salt Lake, Dahlgren remarked: 'This is the place.'

"Dahlgren, in company with Mr. Madsen of the Leonora Mining Company, paid a visit to the company's mining property in the old Star district. This mine, which produced great wealth in early years, was located through a dream and the original claim was known as the Miner's Dream. The high-grade vein in this claim was lost in a faulted area, and efforts have been made since then to relocate the rich vein.

"Dahlgren, after walking over the property Wednesday told Mr. Madsen that his orebody was in the southeast section of the property and that it was down instead of up."

## Output Increases at New Cornelia Copper

G. A. DUNN, flotation operator for New Cornelia Copper at Ajo, Ariz., has just become the father of twins, his twelfth and thirteenth children. The Dunns were married in Albany, Tex., in 1909, when Mrs. Dunn was fourteen years old. She is now thirty-three, and is not only the mother of thirteen children but a grandmother as well, as the eldest of the children, Mrs. Icylee Tipton, of Miami, Ariz., nineteen years old, is married and already has a family of two.

Two children of the Dunns died in infancy, but the rest are all well, and, with the exception of Mrs. Tipton, are living with their parents. Seven of the children were born in Texas and six in Arizona.

## The Interdependence of Mining and Other Industries

SELDOM are facts available that will indicate the degree of interdependence of a group of industries. To assemble such statistics is a laborious proceeding that can be brought to an accurate conclusion only by the painstaking efforts of the agencies representing the various industries concerned. A study of this character has been completed in Utah, chiefly through the efforts of the mining committee of the Salt Lake Chamber of Commerce. The statistics deduced in this instance should be of particular interest to the members of the mining industry. They show clearly and forcibly the important rôle played by mining in that state. Consolidated with similar statistics for the other mining states, they might well be used to advance the national status of the industry.

Perhaps the most striking fact disclosed by the committee's research was that mining in Utah provides the largest home market for the products and services of the other industries of the state, and does so without competing with any of them. Mining employees and their families consume one-third of all the food and livestock produced in the state; the payroll of the industry is one-third of the total payrolls; freight tonnage is 80 per cent of the total carried by the railroads; and 22.8 per cent of the state's total tax levy is paid directly or indirectly by the mining industry. Similar facts for other states and for the entire nation would add much to current knowledge concerning the relative economic position held by mining in respect to other industries. It would also provide an improved basis for determining what demands the industry might justly make on state and national treasuries.

## National Parks, Geology, and the Public

THE nineteen national parks in this country were visited by 2,522,188 persons during the fiscal year ended Sept. 30, according to a recent announcement of the Department of the Interior. This number represented an increase of 7.1 per cent over the preceding year. Yosemite National Park attracted the greatest number, but an inference that this park offers most to the visitor is not justified, for several factors, such as the geographical situation, condition of highways leading to it, and the weather prevailing there, as well as its natural grandeur, are important in determining in what direction tourists head their cars, travel by trains, or trek afoot.

Healthful and educational pleasure is provided annually by the National Parks to these increasing thousands of visitors. Everyone, whether he or she spends the remainder of the year in a crowded city or in the open spaces, will marvel at the works of nature in these parks, and will derive something of lasting benefit from a visit to any of them. Who can view the Grand Canyon, the wonders of Yellowstone, the mountains and lakes of Glacier Park, or the walls of Zion Canyon, for instance, without being profoundly impressed?

"Scenic beauty" is the popular term used to describe the appeal that the national parks have for the visitor. Specifically, however, unusual geologic formations and phenomena comprise the greater part of this scenic beauty. What the tourists see and marvel at is impressive geology. They may not be able to "read" it to the degree that the members of the mining profession can, but their interest has been aroused. As a result, geologic understanding, nationally speaking, should increase, for a certain percentage of these visitors will wish a scientific explanation of what they have seen, as well as a knowledge of how many hours it took to "do" a certain park, or what the record was in miles per gallon.

# INDUSTRIAL PROGRESS

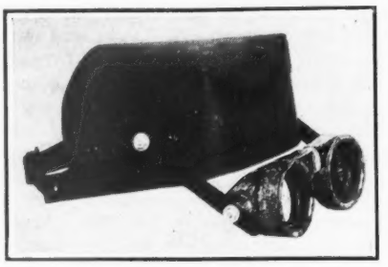
## The Equipment Review

THE most recent addition to the power-shovel equipment available to mining companies is the new group of 2-cu.yd. shovels (Type 480) introduced by the Marion Steam Shovel Company. The capacity and the general features of construction are the same in these three machines. Construction of the underframe and crawler is identical; likewise the dimensions of the boom, handle and dipper; and their crane, clamshell, and dragline equipments are uniform. They differ in the type of primary power supply used, being equipped respectively with steam, electric and Diesel-electric drive.

With a 25-ft. railroad-shovel-type boom, combining wood and steel; with a 17-ft. inside dipper handle, also of wood and steel; and with 2-cu.yd. dippers, they follow closely the design of the company's Type 37 machine. They are heavier, however, and more strong and powerful, and have better balance. All bearings are bronze-bushed. Propulsion is effected through spur-gears at all points of heavy tooth load. A patented handle spacer prevents "bowed" dipper sticks. Sheaves and drums are large, the slide plate and yoke block being of steel and in one piece.

The Diesel-electric model is a new development. The drive equipment includes a Winton Diesel engine direct-connected to a d.c. drooping voltage generator. This supplies the power for the motors, which are geared individually to the hoist, swing, and crowd. This shovel is a duplicate of the electric-driven model. The Diesel engine develops 150 hp. at 750 r.p.m.; the generator is rated at 50 kw., the hoist motor at 90 hp., 60 min. rating, and the swing and crowd motors at 30 hp. The Diesel engine itself is a six-cylinder model, 7x8½ in. in dimensions, and of the four-cycle airless injection type. A Winton standard starter, operating at 400 lb. air pressure, is used.

*In this type the goggles are attached to a lattice skeleton cap*



*Cap type of helmet goggles for welding*

### Some New Welding Goggles

Two new types of helmet goggles for welding purposes have been introduced by the Oxweld Acetylene Company, New York. They are shown in the accompanying illustrations. The cap type (No. 9) consists essentially of a strong fiber cap to which the goggles are attached by fiber links. These goggles can be raised readily over the forehead or lowered over the eyes with one hand. The bridge is adjustable and covered with rubber insulation. Colored lenses are used and are replaceable. They are protected by covers of clear glass. The other type shown (No. 10) is the same, except that the goggles are attached to a lattice skeleton cap. Both styles can be adjusted for head size.

### A Novel Recording Instrument

A new ammeter having some interesting points has been announced by the Roller-Smith Company, New York. It is known as the Type HEA-3 polyphase ammeter and is intended for application specifically to three-phase, alternating-current circuit. With it readings may be taken simultaneously in each phase of a three-phase circuit so that an observer can see at a glance what the current is in each and thus determine instantly whether they are properly balanced. The instrument is provided with a scale 7⅛ in. long. It occupies a relatively small space compared with that required by the three instruments which it supplants.

## A Modern Way of Making Piston Rings

PISTON rings in Diesel engines have three important functions—namely, holding compression; keeping down oil; and dissipating heat. All three functions depend on uniform contact with the cylinder wall, which must be maintained through the life of the ring, and a uniform bearing on the lands of the grooves. To be correct a piston ring must be designed so that it bears uniformly on the cylinder wall and is flat on a surface plate in order to seal against the lands of the grooves. A ring can be inspected for roundness by putting it in a cylinder and holding a light behind it. Failure to bear evenly on the cylinder wall can be easily observed in this manner. The ring can be checked for flatness on the face by putting it on a surface plate and applying a weight sufficiently heavy to flatten out any slight twist caused by handling. It should then lie flat. The flatness can be determined by the use of blue on the surface plate.

Hammered piston rings have been used in Diesel engines since the last part of the nineteenth century, when the Davy-Robertson Company, of Gothenburg, Sweden, made exceptionally good rings by peening. It was not until about 1920, however, that hammered rings were made from individual castings which greatly increased their uniformity.

On the average, Diesel-engine rings show a hardness on the Rockwell B scale of between 90 and 100. Their wearing quality, however, is better determined by micro-photographs, as the structure of the metal is far more important than its hardness. The American Hammered Piston Ring Company, of Baltimore, which makes the rings used in the Phelps Dodge Corporation's Nordberg Diesel engines, finds it necessary to make over seven complete chemical analyses a day, including carbon determinations, as well as daily micro-photographs of the rings, in order to maintain the uniformity which is so vital.

Piston rings in over 7,000 different sizes, ranging from 1½ in. to 72 in. in diameter, are made by the company referred to. These rings are not cut from pot castings, which is the general practice in small machine shops, but are cast individually to within a few thousandths of the size of the finished ring. The material used is a uniform, close-grained resilient cast iron, free from porosity and blowholes.

The rings are individually cast, so that, when finished, they are free from

unequal shrinkage strains and have the graphitic carbon so distributed and proportioned as to produce an iron giving exceedingly long life to both cylinder liner and ring. All surfaces of the casting are machined, which allows adequate inspection of the metal beneath and is insurance against sand holes, shrinkage spots, and other imperfections that might be covered up by casting scale; after which the ring is milled with a step angle or special joint, as specified.

The ring, then practically free from tension and all casting strains, is hammered on its inner circumference mechanically, which gives a life-long tension to it. The hammering machines produce uniform blows, accurately spaced to a predetermined design, generating a permanent, uniform tension in the ring which, when installed, causes it to expand with equal pressure at every point of the circumference against the cylinder walls. Any possible internal flaws or imperfections in the metal, not noticeable on the surface, will become apparent during the hammering operation, as only sound metal can withstand the effect of the hammer blows.

The word "tension" here means the pressure required to close the ring to the gap which it will have when installed in the cylinder by applying a force at two points diametrically opposite this joint. This is transposed to pressure per square inch by a simple formula. Five pounds per square inch is the standard for Diesel engine rings, although some engines require much more. Any tension desired may be obtained by the method described.

The advantage of obtaining tension by peening is that the tension is on the inside of the ring, whereas the wear is on the outside, so that the ring does not lose its tension in direct proportion to the wear. After the ring is hammered, it is finished on the face on Heald grinders, then closed together, and locked on an arbor, where it is re-turned to the exact cylinder size, thus allowing the proper clearance in the gap.

## BULLETINS

SPEED REDUCERS—Palmer-Bee Company, Detroit, Mich. Herringbone speed reducers. A four-page bulletin.

ENGINEERING INSTRUMENTS—A. S. Aloe Company, St. Louis. Equipment for "Field and Drafting Room." Contains 132 pages.

GEARS — General Electric Company, Schenectady, N. Y. Bulletin GEA-482A entitled "Silent Gears, Fabroil and Textolite."

BELT DRIVES—Allis-Chalmers Manufacturing Company, Milwaukee, Wis. Bulletin No. 1228-H. Texrope drives. Sixteen pages.

ROLLER BEARINGS—Orange Roller Bearing Company, Orange, N. J. Eight-page bulletin describing Orange tapered roller bearings.

UNIT HEATERS—American Blower Corporation, Detroit, Mich. The Sirocco unit heater for industrial plants. Bulletin 7418. Thirty-one pages.

LOCOMOTIVES — George D. Whitcomb Company, Roselle, Ill. Bulletin 2822, covering 2½-, 3½-, 4½- and 5-ton gasoline locomotives. Twelve pages.

ELECTRIC HEAT—General Electric Company, Schenectady, N. Y. Bulletin GEA-1012 "Electric Heat in General Electric Factories." Thirty-two pages.

HYDRAULIC STANDARDS—The Hydraulic Society, 90 West St., New York, has issued a new edition (78 pages) of the standards recommended by it. Price 50c.

VIBRATING SCREEN — Deister Machine Company, Fort Wayne, Ind. Bulletin No. 19. The Plat-O vibrating screen; also the cone baffle classifier. Eight pages.

MOTORS—Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Bulletin 157 covering the company's RA single-phase motors, rated 1½ hp. and up.

CRUSHERS—Traylor Engineering & Manufacturing Company, Allentown, Pa. Bulletin No. 2099, superseding 1099. The Bulldog jaw crusher. Twenty-six pages.

ARMATURE REPAIR — General Electric Company, Schenectady, N. Y. Bulletin GEA-897A. Repair of armatures for railway and industrial haulage motors. Four pages.

CRUSHERS—Pennsylvania Crusher Company, Broad and Arch Sts., Philadelphia. Bulletins 2003 and 2004 covering two new series of Steelbuilt crushers of the single roll type.

COMPRESSED AIR TRADE STANDARDS—The Compressed Air Society, 90 West St., New York, has issued the third edition of "Trade Standards" adopted by the society. Price 50c.

NICKEL-CHROMIUM ALLOYS — Southern Manganese Steel Company, St. Louis, Mo. A 20-page pamphlet on Amsco "Fahralloy," a series of 13 alloys having nickel and chromium.

BLASTING SUPPLIES—Hercules Powder Company, Wilmington, Del. Two 30-page catalogs, entitled "Blasting Supplies" and "High Explosives and Blasting Powders," respectively.

CENTRIFUGAL PUMPS — The Aldrich Pump Company, Allentown, Pa. Data 71. Multi-stage single suction centrifugal pumps, 500 g.p.m., 300 lb. maximum pressure. Twelve pages.

ARC WELDING—Ohio Brass Company, Mansfield, Ohio. Bulletin No. 525 MB. Portable electric arc-welders, 250 and 600 volts, for use on mine track circuit bonding and general repair work.

REVERSING SWITCH — General Electric Company, Schenectady, N. Y. Bulletin GEA-844A. Across-the-line type of magnetic reversing switch for single-phase, two-phase, and three-phase motors.

CONDUCTOR SUPPORT — Hoist & Crane Engineering Company, 114 Liberty St., New York. Data sheet covering conductor supports, insulators, conductor bar clamps, ears, strain insulator and takeup, and fittings.

HEAT INSULATION—Celite Products Company, 1320 South Hope St., Los Angeles. Bulletin No. 102 on "Heat Insulation in the Smelting and Refining of Non-Ferrous Metals." (Sil-O-Cel insulation is referred to.)

DRILL SHARPENING—Flottmann's review entitled "Der Bohrhammer," published at Herne, Westphalia, Germany, contains an article in its September issue entitled "The Use of the Drill-Sharpening Machine for Various Forge Operations."

MINE SAFETY APPARATUS—Mine Safety Appliances Company, Pittsburgh, Pa. Three bulletins covering, respectively, the Torridaire hot pad, the new Edison model F miner's electric safety cap lamp, and the improved Burrell gas indicator.

ROTARY DISPLACEMENT METERS—Connersville Blower Company, Connersville, Ind. Bulletin 4D, including a brief history of the development of the double-impeller type of blower or pump and of the rotary displacement meter. Twelve pages.

MOTORS — General Electric Company, Schenectady, N. Y. Bulletin GEA-71B on wound-rotor induction motors, 220, 440, and 550 volts, ¾ to 10 hp.; also bulletin GEA-81B on high torque double squirrel-cage motors in 2-phase and 3-phase types.

INDUCTION MOTORS — Allis-Chalmers Manufacturing Company, Milwaukee, Wis. Bulletin 1118-E. Polyphase Induction Motors. Sixteen pages. These are general purpose motors in the slip and roller-bearing types built with steel frames.

METALLIC PACKING—France Packing Company, Tacony, Philadelphia. Two rotogravure sheets, entitled "Pictorial News," and showing installations where metallic packing is used. Also, a folder entitled "What Is the Life of Metallic Packing?"

ELECTRIC STEEL PRODUCTS—La Consolidada, S. A., Mexico City, Mexico. An attractive pamphlet of 96 pages featuring in the first fifteen pages crusher parts and other steel castings made by the company. The rest of the book is given over to the presentation of flow sheets and other data relating to Mexican mining companies.

SWITCHES—General Electric Company, Schenectady, N. Y. Bulletin GEA-821A on pressure and vacuum switches, a.c. or d.c., maximum voltage 550, maximum pressure 200 lb. and maximum vacuum 28 in.; also bulletin GEA-952, on automatic transfer switch for mine gathering locomotives; also bulletin GEA-572A, on automatic switch equipment for synchronous converters in mining service.

POWER SHOVELS — The Marion Steam Shovel Company, Marion, Ohio. Four bulletins as follows: No. 336, Type 480, 2-yd. steam shovel. No. 335, Type 480, 2-yd. electric shovel, with Ward Leonard control. No. 334, Type 480, 2-yd. electric shovel with rheostatic control. Bulletin No. 337, Type 450, 1¼-yd. gas-electric shovel. These four bulletins cover 1¼- and 2-cu.yd. shovels, draglines, and clamshells.

CYANIDATION — The Merrill Company, 343 Sansome St., San Francisco. A 96-page catalog describing the Merrill-Crowe precipitation process and other processes and equipment supplied by the company. The bulletin points out the recently developed modification of the original Merrill-Crowe precipitation process, in which submerged vacuum leaves are utilized for collecting the gold-silver precipitates. This process was first used in Mexico, and has since been utilized in a number of recently constructed plants in Africa and South America.

## INDUSTRIAL NOTES

Frank M. Hunter has returned from Canada and is with the Keith Dunham Company, of Chicago, as engineer in that company's L.O.X. division.

Barney G. Tang, assistant general superintendent of the Schenectady Works of the General Electric Company, has been made general superintendent to succeed James A. Smith, who died on Oct. 25 last. John D. Harnden has been made assistant to the works manager and LeRoy Beers engineer.

# PATENTS

MINE CAR. No. 1,689,056. Oct. 23, 1928. Otto Sann, Johnston, Pa.

MINE LOCOMOTIVE. No. 1,691,815. Nov. 13, 1928. Benjamin K. Kirk, Philadelphia.

AIR-LINE OILER. No. 1,689,780. Oct. 30, 1928. George W. Hulshizer, assignor to Ingersoll-Rand Company.

BLASTING EXPLOSIVE. No. 1,689,674. Oct. 30, 1928. R. A. Long, assignor to Atlas Powder Company, Wilmington, Del.

CORE DRILLING APPARATUS. No. 1,690,469. Nov. 6, 1928. Eugene Whinnen, assignor to Sullivan Machinery Company.

CRUSHER. No. 1,691,553. Nov. 13, 1928. H. H. Rumpel, assignor to Smith Engineering Works, Milwaukee, Wis.

CRUSHER. No. 1,692,161. Nov. 20, 1928. John A. Dormer and J. G. Malone, Detroit, Mich.

DRILL-STEEL RETAINER. No. 1,689,408. Oct. 30, 1928. A. H. Skaer, assignor to Gardner-Denver Company, Denver, Colo.

FLOW METER. No. 1,689,776. Oct. 30. 1928. Clarence A. Dawley, Plainfield, N. J.
*Covers a flow meter of the orifice type.*

GRINDING MILL. No. 1,691,210. Nov. 13, 1928. Bernhard Scherbaum, Wedel, Germany.

HYDRAULIC DREDGING. No. 1,691,686. Nov. 13, 1928. LeRoy Vorhies, Denver, Colo.

PULVERIZING MILL. No. 1,690,712. Nov. 6, 1928. L. C. Bonnot, assignor to The Bonnot Company, Canton, Ohio.

ROCK DRILL MECHANISM. No. 1,689,596. Oct. 30, 1928. Charles F. Osgood, assignor to Sullivan Machinery Company.

ROCK DRILL. No. 1,689,275. Oct. 30, 1928. L. C. Bayles, assignor to Ingersoll-Rand Company.

ROCK DRILL. No., 1,689,869. Oct. 30, 1928. Elmer G. Gartin, assignor to Sullivan Machinery Company.

ROCK DRILL. No. 1,691,570. Nov. 13, 1928. C. C. Hansen, assignor to Ingersoll-Rand Company.

VALVE. No. 1,689,799. Oct. 30, 1928. Sven J. Nordstrom, assignor to Merco Nordstrom Valve Company, San Francisco.

DRILLING PROSPECTING HOLES. No. 1,688,994. Oct. 23, 1928. Eggleston Smith, assignor to Eggleston Drilling Corporation, Delaware.

MECHANISM FOR ROTATING DRILL CHUCK. No. 1,689,392. Oct. 30, 1928. August H. Katterjohn, assignor to Gardner-Denver Company, Denver, Colo.

FLOTATION. No. 1,688,998. Oct. 23, 1928. Frederick Swinney, deceased, by Rose Lima Swinney, administratrix, Tucson, Ariz.

ROCK DRILL. No. 1,691,404. Nov. 13, 1928. E. G. Gartin, assignor to Sullivan Machinery Company. Patents Nos. 1,691,405-6-7 also cover details of rock-drill mechanism.

ELECTROLYTIC DEPOSITION. No. 17,141. Nov. 20, 1928. A re-issue. Gunnar Rosenquist, Pittsburgh, Pa.
*This covers apparatus for producing articles by deposition.*

ELECTRIC FURNACE. No. 1,690,678. Nov. 6, 1928. A. J. Hanson, assignor to American Metallurgical Corporation, Boston, Mass.
*Covers certain features of design in an electric resistance furnace.*

LITHOPONE. No. 1,690,099. Nov. 6, 1928. F. G. Breyer and C. W. Farber, assignors to New Jersey Zinc Company, New York.
*Covers an improvement in the manufacture of lithopone.*

BREATHING APPARATUS. No. 1,691,648. Nov. 13, 1928. A. B. Dräger, and Elfriede Dräger, executrix of A. B. Dräger, deceased, Germany.
*This patent covers a breathing apparatus of the well-known Dräger type.*

REDUCTION OF METALS FROM ORES. No. 1,690,820. Nov. 6, 1928. John W. Hornsey, assignor to Granular Iron Company, Michigan.
*Covers certain details of design of a rotating cylinder furnace intended for the solid reduction of ores.*

FLOTATION OIL. No. 1,688,975. Oct. 23, 1928. Royer Lukenbach, Brooklyn, N. Y.
*This oil comprises a heavy petroleum residuum, together with a petroleum diluent and a frother containing cottonseed foots, pine creosote, and a soap.*

FURNACE-TAPPING MACHINE. No. 1,688,327. Oct. 23, 1928. Edgar E. Brosius, Pittsburgh, Pa.
*A blast-furnace apparatus comprising a suspended rotatable drill, the position of which can be changed as convenience may demand.*

GRINDING MILL. No. 1,690,125. Nov. 6, 1928. Charles E. Needham, assignor to Bethlehem Foundry & Machine Company.
*Covers a centrifugal grinding mill having a grinding chamber with movable grinding rolls, a vertical shaft for moving the rolls, a base casting, interchangeable uprights, and an overhead structure to support the shaft.*

FLOTATION. No. 1,689,693. Oct. 30, 1928. Cooper Shapley, Bishop, Calif.
*A process of separating finely divided particles by flotation, by bringing them in contact with a soap solution which does not chemically react with them, and then bringing them to the surface of a body of water free from any reagent which would decompose the soap.*

PREPARING SULPHUR. No. 1,688,357. Oct. 23, 1928. Hans Schrader, Essen-Bredeney, and Harold Schoeller, Essen, Germany.
*A process for producing sulphur of a high degree of dispersion by dispersing sulphur vapors by means of a gas comprising ammonia and then separating the sulphur from the resulting fume.*

FLOTATION. No. 1,690,907. Nov. 6, 1928. Robert E. Phelan and Sherwin P. Lowe, assignors to R. H. Channing, Jr., Denver, Colo.
*This covers, in a froth flotation process, the method of separating micaceous and talcky minerals from the concentrates by adding starch to the pulp and making the latter non-alkaline to prevent the minerals from entering the froth and then subjecting the pulp to flotation.*

REDUCING OXIDES TO METALLIC FORM. No. 1,690,916. Nov. 6, 1928. Sigurd Westberg, Pittsburgh, Pa.
*A method involving the bringing together of such oxides or ores and carbonaceous material in the presence of sufficient heat to cause them to react; also the converting of the carbon monoxide formed during the reaction into hydrogen or a hydrogenous gas and the introduction of this gas into the reaction zone.*

SINTERING MACHINE. No. 1,690,231. Nov. 6, 1928. B. G. Klugh, assignor to American Ore Reclamation Company, New York.
*This patent covers, in a sintering machine, an endless track on which a number of pallets move, also a magnetic means for controlling the travel of the pallets so as to keep them in contact along a particular portion of the track. Means are provided for varying the intensity of the magnetic action.*

FLOTATION. No. 1,690,225. Nov. 6, 1928. A. W. Hahn, Salt Lake City.
*A process of recovering metals from their ores by treating the pulp to the oxidizing action of bleaching powder in the presence of an alkaline substance and thereby precipitating oxides associated with the values to be recovered by changing them into higher oxides and then adding a flotation agent and subjecting the pulp to a froth flotation.*

MAKING ZINC DUST. No. 1,688,426. Oct. 23, 1928. Franklin P. Lannon, Jr., assignor to American Smelting & Refining Company, New York.
*This method consists of the production of zinc dust in a state of minute subdivision from zinc fumes by circulating the zinc fumes vigorously and rapidly cooling them to a point considerably below the vaporizing temperature, whereby the zinc particles are solidified as they are incipiently condensed and formed.*

WOOD PRESERVATION. No. 1,690,390. Nov. 6, 1928. Charles Williams and Ferdinand Francois, assignors of one-third to Eddy Bozonier, Oakland, Calif.
*A wood-preservation composition is covered. It consists of approximately the proportions of 2 gal. of paraffine oil, 2 gal. of naphthalene, 3 gal. of benzol, 2½ gal. of light creosote, 2½ gal. of heavy creosote, 5 gal. of oil of tar, 5 lb. of cement, 5 lb. of hydrated lime, 5 lb. of sulphur and 20 oz. of paris green.*

DIRECT REDUCTION OF IRON ORES. No. 1,689,734. Oct. 30, 1928. Toussaint Levoz, assignor to N. V. Handelmaatschappij Ferriron, Rotterdam, Netherlands.
*This patent covers the steps of forming a charge comprising iron ore, reducing carbon, oxides of alloy metals such as silica and manganese, and a low melting point aluminiferous flux; also subjecting the charge to a comparatively low temperature to produce a low-carbon ferro-alloy and a covering slag; also, raising the temperature to reduce the carbon content of the alloy by interaction of the carbon with the oxidized aluminum in said slag; and then reducing the components other than iron of the alloy by means of an oxidizer.*

LEACHING ORE IN PLACE. No. 1,690,446. Nov. 6, 1928. R. F. Grant, F. B. Richards and H. E. Wetherbee, assignors of one-fourth to Howard M. Hanna, Cleveland, Ohio.
*This patent covers operations for insuring the leaching of copper ore in place, by driving a shaft and connecting drifts to widen operations at a level below that of the surface water, and providing localized trenches or containers at the surface appurtenant to such underground work; also supplying a solution of ferric sulphate of approximately 4 per cent dilution above the drifted area of copper ore, and permitting its continued percolation in quantity through the orebody, and pumping the surface water and percolating fluid from the level of the drifts.*

# Personal Notes

E. W. BEDFORD, mining engineer, of Mina, Nev., is in New York.

VICTOR RAKOWSKY, of Joplin, has been at the Biltmore, in New York, this week.

E. P. FLEMING, of New York, is spending two weeks at the Federal Lead smelter, in Illinois.

U. C. TAINTON, metallurgical engineer, of Kellogg, Idaho, is in New York on professional business.

F. R. WEEKES has gone to Manitoba on professional business. His address for the next few months will be The Pas, Manitoba.

L. O. EVANS, head of the legal department of Anaconda Copper, visited Salt Lake headquarters of International Smelting recently.

DAVID R. THOMAS has resigned as advisory engineer to Laval-Quebec Mines, Ltd., and is now located at 2001 Bloor St., West, Toronto, Ont.

R. V. AGETON, until recently accident-prevention engineer of the Tri-State Zinc and Lead Ore Producers' Association, Picher, Okla., is temporarily making his headquarters at Miami, Okla.

C. S. PARSONS, of the Canadian Department of Mines, Ottawa, was in New York this week on his way home following an extended tour of Western milling plants.

Dr. F. J. KATZ, chief of the statistics division of the economics branch of the U. S. Bureau of Mines, visited the Intermountain station of the Bureau at Salt Lake recently.

JOHN KNOX, assistant general manager of Hollinger Consolidated, is making an examination of the McVittie-Graham properties in the Sudbury district, northern Ontario.

A. W. FAHRENWALD is still ore-dressing engineer of the U. S. Bureau of Mines, in charge of the Moscow, Idaho, station, and will not take over his new work probably until some time next spring.

E. A. S. WHITTARD, manager of the Buckingham-Mina mine, near Battle Mountain, Nev., was in Salt Lake recently on business connected with marketing the company's concentrate from its new mill.

A. E. RING, manager of the Rawley Mines company at Bonanza, Colo., and assistant to A. H. Means, head of American Smelting & Refining's Western mining department, visited the Colorado property recently.

MAX W. BALL has resigned as president of the Argo Oil Company to enter in consulting practice. He has established offices in the First National Bank Building, Denver, Colo., and the Exchange National Bank Building, Tulsa, Okla.

VICTOR HEIKES, formerly statistician of the U. S. Bureau of Mines at Salt Lake, and Mrs. Heikes have returned to Washington, D. C., from a nine months' trip abroad. Part of the time in Europe was spent visiting their son, George Heikes, who is a member of the staff at the Anaconda Copper zinc mines in upper Silesia.

JOHN L. BAUMANN spoke on Nov. 27 before the Missouri Mining and Metallurgical Association, School of Mines and Metallurgy, Rolla, Mo., on several mining camps in which he had worked. He told of living conditions, methods of mining, and character and shape of the orebodies in various mines. Among other districts he discussed the Tri-State, Cripple Creek, Leadville, Silverton, and Salt Lake Valley camps.

## OBITUARY

R. T. AUSTIN, mining engineer, died at Long Beach, Calif., on Nov. 24 at the age of 73.

## Joseph Silas Diller—An Appreciation

THE late Joseph Silas Diller, for 40 years a federal geologist, was born of Swiss parentage, near Plainfield, Pa., Aug. 28, 1850. At 23 years of age he became a teacher in the State Normal School at Westfield, Mass., holding this position until 1877. He then went to Harvard University and received the degree of B.S. from the Lawrence Scientific School in 1879. For the next four years, 1877-1882, he was engaged in post-graduate work at Harvard and Heidelberg, Germany, specializing in petrology. During part of this time he made a journey to the region of the ancient city of Troy, Asia Minor, as the geologist of the Assos Expedition and published a summary of his results in "Notes on the Geology of the Troad," in *Science*, Vol. 2, August, 1883. He was married June 5, 1883, to Laura I. Paul, of Greason, Pa. In August, 1883, he was made an assistant geologist on the U. S. Geological Survey and was assigned to a study of the Cascade Range, under the direction of Captain C. E. Dutton, who has written in complimentary terms of his work. He was promoted to geologist in 1890, a rank which he held until he retired in 1923. On his first assignment, he visited Lassen Peak and Mount Shasta, in California, and Crater Lake, Mount Scott, Union Peak, Mount Thielson, Diamond Peak, and the Three Sisters, in Oregon. In climbing one of the Three Sisters the party met with a serious accident, which nearly ended his career, a high cliff caving and giving way beneath them.

Mr. Diller published many geologic papers, among which the best known are "Geology of the Lassen Peak District"; "Mount Shasta, a Typical Volcano"; "Geologic History of Crater Lake"; "Topographic Development of the Klamath Mountains"; "Tertiary Revolution in the Topography of the Pacific Coast"; "The Roseberg, Coos Bay, Port Orford, Lassen Peak, and Redding Folios"; "Auriferous Gravels in the Weaverville Quadrangle, California"; "Auriferous Gravels of the Trinity River Basin, California"; "Mineral Resources of the Grants Pass Quadrangle"; "Mineral Resources of Southwestern Oregon"; Placer Mines of the Riddles Quadrangle"; "A Geological Reconnaissance in Northwestern Oregon"; "Guidebook of the Shasta Route"; "The Educational Series of Rock Specimens Collected and Distributed by the U. S. Geological Survey"; "Chromic Iron Ore"; "Talc"; "Asbestos"; and many others. He described Lassen Peak as our youngest volcano in 1893, and twenty years later had the satisfaction of seeing it in eruption, and he then called it our most active volcano. In 1897 he brought out the proof that the mountain surrounding Crater Lake is all that remains of a huge volcanic cone like Shasta that has collapsed and subsided.

To most persons residing on the Pacific Coast no scientist was held in higher repute than Mr. Diller. To the many younger geologists who assisted him in the field, he was always thoughtful and considerate, and was the source of many of their ideas. He often put himself out to give them opportunities for advancement and was regarded by them, first of all, as a friend. Coming to the Geological Survey in the fourth year of its existence, he had been associated with many of the foremost geologists of America, and with his high scientific standards and his wholly unselfish and kindly personal characteristics, he constantly exerted a quiet but strong and most beneficial influence on the development of that organization.

Mr. Diller served as vice-president of Section E of the American Association for the Advancement of Science; vice-president of the Geological Society of America; president of the Geological Society of Washington; secretary and manager of the Washington Academy of Sciences; corresponding member of the Appalachian Mountain Club; honorary member of the Mazamas; and member of the A.I.M.E. In recognition of his service to geology, bronze medals were conferred on him by the Paris International Exposition in 1900 and by the Panama Pacific International Exposition in 1915. He had been for many years a member of the Cosmos Club, of Washington, and of the First Congregational Church. He retired from active work on Dec. 31, 1923, and died Nov. 15, 1928. His body was buried in the churchyard at Plainfield not far from the place of his birth.

GEORGE OTIS SMITH.

# NEWS OF THE WEEK

## *Summary*

*AT the annual Western meeting of the Canadian Institute in Vancouver, a large number of members were present to hear of notable developments in the industry in British Columbia, Saskatchewan, Alberta, and Manitoba. T. A. Rickard describes the proceedings. Page 918.*

* * *

*Eagle-Picher Lead is experimenting with the Rhéolaveur launder-washing process at its Crawfish mill in the Tri-State district. If successful it may supplant to a large extent the jigging methods used in the district. Page 916.*

* * *

*Boom days hardly equaled in the historic beginnings of Cripple Creek, the Yukon, Kalgoorlie or Goldfield, followed on the heels of a startling discovery of gold in East Orange, N. J. Read the palpitating details. Page 917.*

* * *

*The possibilities of producing tin in Alaska both from lode and hydraulic mines are being tested by a syndicate, headed by G. C. Lemons. Claims have been obtained at Lost River and in the Hot Springs district. Page 916.*

* * *

*Activity in the old Boundary district of British Columbia, once the center of mining operations in the province, has been renewed as a result of higher copper prices. Page 919.*

* * *

*On Dec. 6, the new mines building of the University of Utah was dedicated. It will also house part of the Intermountain station of the U. S. Bureau of Mines. Page 915.*

* * *

*The Carmen de las Virgenes mine, in the El Oro district of Mexico, is being closed down. Page 920.*

* * *

*Van Dyke Copper, which adjoins the Miami Copper mine on the south, is being reopened. Page 916.*

## Budget Cuts Down Allotment to Bureau of Mines Almost $500,000

By Paul Wooton
*Special Washington Correspondent*

A HEAVY contribution to the economy program was exacted from the U. S. Bureau of Mines, the annual budget submitted to Congress on Dec. 3 reveals. Unless Congress over-rides the budget, the Bureau of Mines will have nearly half a million dollars less to spend during the next fiscal year than was appropriated for the work this year. This includes $335,910 apparent decrease, to which must be added the salary increases prescribed by Congress.

The budget submitted by the President at the opening of Congress allows a total of $2,249,670 for the Bureau. Small increases were allowed on a few items. Enough was allowed to permit of the Fosterizing of the Reno experiment station. This is the station where special attention is given the precious and the rarer metals. There has been a persistent demand for many years from the industries concerned for more research work of this character of the type which can be done best by the government. The recommendation for all experiment stations is $205,450.

Some $15,000 additional is made available for the work of the mining division, which has under way studies of geophysical methods of prospecting, mining methods, and costs; underground mechanization; mine ventilation; ground movement; subsidence; sampling of ore and coal; shaft sinking; exploration work and other matters of great interest to those engaged in metal mining. The total amount recommended is $144,220.

On May 28 Congress passed the Welsh act, arbitrarily increasing the salaries of all federal employees, regardless of individual merit. Apparently in compiling the budget it has been the intention, in many instances, to make no allowance for the increased salaries, which means a proportionate reduction in the amount of work that can be done.

In the $91,500 item providing for general administrative expenses, allowance is made apparently to take care of only a part of the Welsh act increases. In the same way an increase to $422,000 in the amount recommended for the investigation of mine accidents apparently does little more than allow for the general salary increase. There is a reduction of $35,000 in amount allowed for operation of mine rescue cars and stations. This is due to the fact that a new mine rescue car was authorized last year, but this year the $326,130 recommended will have to absorb the salary increase.

The estimate for the testing of fuel is $179,210. This is largely a service activity for other departments of the government, but after the increased pay is taken into account there is left something near $10,000 for a study of the recovery of liquid fuels from coal. The recommendation for the oil and gas investigations is $232,000. This allows an additional $25,000 for the study of natural-gas utilization.

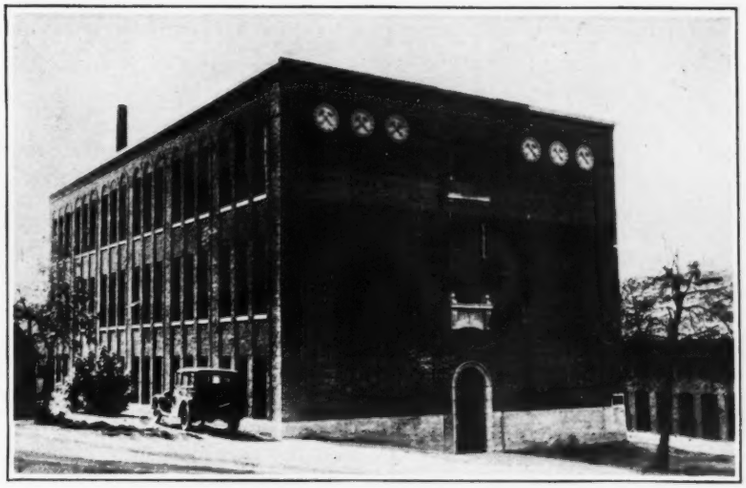
In the present budget the $75,000 item which has been allowed for oil-shale investigations is dropped. Provision is made for $82,200 for the care of buildings at Pittsburgh. This is a slight increase, apparently more than offset by salary increases.

The economic branch is allowed a sufficient increase to provide for four more employees during the next fiscal year—a statistician at $3,200; an associate economic analyst at $3,200; an assistant engineer at $2,600, and a statistical clerk at $1,800.

When all the figures are reviewed the bare fact remains, regardless of explanations made in the report of the Director of the Budget, that the Bureau has lost well over $400,000. The worst feature of this is the fact that it is extremely difficult under the system to regain lost ground in the matter of appropriations. It is the experience of all bureaus that increases are open to the many hazards of budget and committee objections. It is becoming more and more apparent that there is a determined effort to force reductions upon activities that do not exert their political strength and to favor those where it is brought to bear.

The Geological Survey was allowed an increase of $130,000 in the amount recommended for topographic mapping.

Slight increases were allowed when the Welch increases are deducted for geological surveys and for the engraving of maps. The amount recommended for geological surveys is $350,000. In addition, $67,500 is proposed for the continuation of the investigation of the mineral resources of Alaska.



*New mines building of the University of Utah, at Salt Lake City*

# New Mines Building Is Dedicated at University of Utah

ON DEC. 6, in the presence of leading Utah mine operators, the Chamber of Commerce mining committee, the board of regents, and the president and members of the faculty, the new University of Utah mines building, at Salt Lake City, was formally dedicated. President George Thomas presided; Dr. Joseph F. Merrill delivered the invocation; James W. Wade, representing the board of regents, and W. Mont Ferry, of the Chamber of Commerce mining committee, made short speeches; and Dr. Hylon T. Plumb delivered an address on "Scientific Research." The dedication program was in charge of Dr. Dorsey A. Lyon, supervising engineer of the U. S. Bureau of Mines Intermountain station and head of the department of mining and metallurgical research of the University of Utah.

New and better classrooms and additional room for research are made available by the new building. Undergraduate work has been transferred to the new mines building, thus permitting the Bureau of Mines staff and the department of mining and metallurgical research to occupy the space in the old building formerly occupied by the undergraduate department in mining and metallurgy.

Space is also provided for the new safety station established at Salt Lake by Congressional appropriation. The equipment for this unit has been installed, and Dr. Dorsey J. Parker, supervising engineer, has taken charge of mine rescue and safety activities. He also has two mine safety cars in his charge, as well as mine rescue and safety work at the Berkeley and Seattle stations.

The new building is 90x46 ft. and three stories high. Constructed of steel and concrete, it is fireproof throughout. The east side of the ground floor will be occupied by the University of Utah department of mining and metallurgy, with the exception of the space given over to the apparatus room of the mine safety and rescue unit. On the west side of the first floor is a garage for the Bureau of Mines rescue truck and also a locker room with showers. The mine rescue apparatus room is 14x19 ft. A large humidor has been built for storage of self-contained oxygen breathing apparatus and rubber parts of gas masks and other equipment.

On the second floor of the new building is a large lecture room, 45x30 ft., with a mine research laboratory to be devoted to geophysics; three offices for Bureau of Mines officials; a smaller lecture room, 20x20 ft.; and a gas analysis laboratory 20x20 ft., belonging to the Bureau of Mines.

The west side of the third floor is occupied by the library, 45x25 ft. The mining library has been generously endowed by James McGregor, a Park City mining man, with a bequest of $50,000, called the McGregor Fund. There are also on the third floor two offices, a drafting room, 18x26 ft.; a storeroom, 18x10 ft., and a ventilation laboratory known as the smoke room.

## Chromite Strike in Ontario

Chromite deposits assaying over 48 per cent have been discovered west of Armstrong Station, in Ontario, Canada, according to dispatches received by the U. S. Department of Commerce. The ore occurs in a dike about 700 ft. wide and a mile in length. The point is emphasized that inasmuch as the United States consumes over one-third of the world's chromite output, the new strike should be of importance to American producers of ferrochrome and of chrome chemicals and to the rapidly growing chrome steel and chromium plating industries.

## Chilean Earthquake Kills Seventeen at Braden Mine

The severe earthquake that occurred in south-central Chile on Dec. 1 and 2, killing from 250 to 300 people, resulted in at least 17 deaths at the El Teniente property of Braden Copper, near Rancagua, according to a telegram received from W. S. Culbertson, American Ambassador at Santiago, by the U. S. Department of State. The quake resulted in bursting the company's dam, and the subsequent floods caused the fatalities. Operations will be affected only temporarily.

## Consolidated Coppermines Adds Ventilating Equipment

The Consolidated Coppermines Corporation, at Kimberley, Nev., has installed three additional ventilating units —one 5-hp. Vano mine blower for 16-in. pipe and two 5-hp. Ventair mine blowers for use on long runs of 12-in. pipe, made by the Coppus Engineering Corporation. This makes, in all, eighteen Coppus ventilation units installed at the Kimberley property this year.

## West Kootenay Will Furnish Power for Slocan District

Lorne A. Campbell, vice-president and general manager of West Kootenay Power & Light, has announced that the company will extend its transmission lines about 75 miles to serve the silver-lead-zinc mines of the Slocan district of British Columbia. The cost of the extension is estimated at $450,000.

## Alaskan Lime Quarries Now in Operation

The Dall Island lime quarries, in Alaska, are now in active operation in conjunction with the Pacific Coast Cement Company's cement plant at Seattle. About $3,000,000 has been expended in development and equipment. The crushing capacity is 100 tons of limestone per day. Crushed rock is loaded on ship with belt conveyors.

## Hewitt Acquires Helena Mine

C. L. Hewitt, and associates, have purchased the properties formerly owned by Blackfoot Silver Lead Mining, in the Silver Camp district, north of Helena, Mont. Jack Rowand was formerly chief owner of the old company. The property is being reopened and a flotation plant will be installed.

## Butte Copper Consolidated Starts Crosscutting

Butte Copper Consolidated Mines, operating the Joe Dandy property, near Radersburg, Mont., has temporarily stopped shaft sinking and has started crosscutting to the orebodies mined in the upper levels of the mine. The shaft is now 472 ft. deep.

## Reopen Van Dyke Copper in the Miami District

VAN DYKE COPPER, which owns property adjacent to and southeast of the Miami Copper and Inspiration mines, in the Miami district, Ariz., has decided to resume operations. Exploration of the property was first started in 1916, when a diamond-drill hole was put down to a depth of 1,219 ft. and a shaft was sunk to a depth of 1,700 ft. In the shaft a carbonate orebody, 30 ft. thick and averaging 3.25 per cent copper, was passed through. Some drifting was done from the shaft on the 1,220 and 1,550 levels.

Later a second diamond-drill hole was put down to a depth of 2,702 ft. In this hole, 51 ft. of carbonate ore, said to average about 4.5 per cent copper, was struck. The company has decided to retimber the shaft and drift toward the orebody struck by the diamond drilling. The ore now being mined by Miami Copper lies on the north side of the Miami fault, and the Van Dyke company will make an effort to locate the portion of the Miami orebody which is believed to lie on the south side. Some exploration has been done by Miami Copper with this end in view, but without favorable results.

## Water Continues to Hinder Sinking at Tom Reed

SINKING operations of both the main shaft and the winze at the Tom Reed mine, in the Oatman district, Ariz., have been hindered by water encountered. Recently work in sinking the winze from the 800 level to the 900 level was stopped until a new pump was installed. The management intends to continue both the shaft and the winze to the 1,100 level and connect them at that point.

As a result of the intermittence with which underground operations have been carried on, the mill has been handling only about 60 tons daily, but as soon as it is possible to resume work regularly this tonnage will be stepped up to 100 tons. The drift on the 800 level of the mine is nearing the west end of the United American property and is in high-grade ore.

## Suit Started Over North Carolina Gold Mine

THE case of Rich-Cog Mining against William S. Graves and Paul A. Rinck, involving a claim of about $125,000, has been transferred from the Rockingham Superior Court to the U. S. district court at Greensboro, N. C. The company, which owns a tract of about 829 acres in Montgomery County, N. C., including the Russel and Coggins mines, claims that it agreed to sell its holdings, which carry gold ores, to the defendants for $125,000 and that thus far they have paid only $750.

According to the complaint, the defendants will not give the necessary information for the filing of a deed, and the plaintiff asks the court to force them to carry out the agreement.

The Coggins mine is the most recent development of any magnitude in the North Carolina gold-mining industry. An incline shaft has been sunk to a depth of more than 500 ft., with levels at 100-ft. intervals.

## Eagle-Picher Testing Rhéolaveur Process

AN EXPERIMENTAL installation of the Rhéolaveur launder-washing process at the Crawfish mill of the Eagle-Picher Lead Company, situated at Picher, Okla., is being watched with considerable interest by the operators in the Tri-State district. The installation is now undergoing test, and if successful it may supplant to a large extent the jigging operations employed in the district. A mixed galena and zinc blende concentrate of coarse and sand sizes is produced, and this is separated on a jig into galena and zinc blende concentrates. The finer metallic particles are recovered with the customary flotation equipment. The installation was made by the American Rhéolaveur Corporation, Wilkes-Barre, Pa., and the tests in progress are under the direction of M. Walle, metallurgist of the corporation.

## U. S. May Be Independent of Foreign Potash

INDEPENDENCE from foreign potash supplies by the United States is viewed as probable by the Secretary of Interior in his annual report to the President. The report states that all of eight core tests made in Texas and New Mexico show the presence of potash-bearing mineral and that three of the sites give promise of commercial development. This work is being conducted co-operatively between the U. S. Geological Survey and the Bureau of Mines in accordance with the potash act of 1926.

## Cripple Creek Freight Rates Have Been Reduced

A reduction in freight rates on low-grade ore shipped between Cripple Creek and Colorado Springs, Colo., has been announced by the Midland Terminal Railroad. The reduction amounts to 25c. a ton on ore with a gross value of $4 a ton. The railroad's lowest rate is now reported to be 50c. a ton. This makes a total of $2.25 for transportation to and treatment at the Golden Cycle mill, in Colorado Springs, for low-grade Cripple Creek ore.

## Alaska Has Tin Lode and Dredging Possibilities

A LENGTH of 15 miles on Sullivan Creek, in the Hot Springs district of Alaska, has been secured by G. C. Lemons, who is reported to represent British tin interests, and he has gone to London to close a transaction having for its objective installation of two tin dredges for recovery of the metal contained in the gravel. During the last two years, drilling operations on this tract, which represents a total of 62 claims, have been carried on under the direction of English engineers. In addition to the tin content, sufficient gold is said to be associated with it to insure profitable operation.

At Lost River, a lode tin prospect is being developed by the same organization. A shaft has been sunk to a depth of 300 ft., and 750 ft. of drifting has been done. The vein is reported to be 12 ft. wide and to carry tungsten as well as tin. The camp is equipped with steam heat and electric light, and development work will be continued throughout the winter.

## Association for Advancement of Science to Meet

THE fifty-eighth annual meeting of the American Association for the Advancement of Science will be held in New York at the end of December. The engineering section of the association will hold three sessions on Dec. 29, and will also take part in a symposium on Dec. 28 on "Chemistry of Metals." At the morning session on Dec. 29 the address of the retiring vice-president, Dr. A. Talbot, of the University of Illinois, will be given, and there will be a discussion of engineering education, with particular reference to preparation for research. In the afternoon there will be a symposium on "The Organization of Scientific Research in Industry," arranged by the local committee. At the dinner session there will be a number of addresses on "Contributions of Science to Engineering."

## New Union Sulphur Plant Producing 250 Tons Daily

SULPHUR production by Union Sulphur from its new plant, near Wharton, Tex., is now at the rate of 250 tons a day. The sulphur comes from only one well. Other wells will be placed in operation as rapidly as they can be put down and equipped. The company's mines will probably be placed on a large production scale within the next few months.

Texas Gulf Sulphur has been granted a permit by the State Board of Water Engineers to divert water from the San Bernard River for its sulphur-mining operations and domestic uses at its new town of Newgulf, in Wharton County. The company will dam the river and install a pumping plant.

©Newark Evening News

*Main shaft and power plant at Public Service gold mine, East Orange, N. J. This picture was taken on Nov. 16 as the operations reached a triumphant and productive climax.*

# The Rise, Decline, and Fall of Gold Mining in East Orange, N J.

***Shaft Sunk to 11 Ft. With Standard Mining Equipment, Production Started, and Profitable Future in View Until Officials Decide Gas and Electric Conduits Are More Important***

ON NOV. 15 the Public Service Electric & Gas Company was excavating on the corner of Munn and Central Aves., in East Orange, N. J., with the entirely plebeian and utilitarian motive of providing a manhole whereby necessary repair work on its electric and gas conduits could occasionally be undertaken, when Harold Katzin, one of the men employed in the work, noticed that several bits of rock had a peculiar and fascinating glitter. These specimens were submitted to a jeweler by the excited and expectant Mr. Katzin. He was not disappointed. They were declared to contain gold.

Digging continued feverishly, with gold content apparently increasing, until a depth of 11 ft. was reached. The accompanying illustration shows the status of development on Nov 16, at this property, which was equipped with standard mining equipment including rock drills and an air compressor. As far as *E. & M. J.* has been able to ascertain, however, no mining engineer or geologist was ever given an opportunity to examine the strike—a lamentable fact in view of the succeeding tragic history of the property.

On Nov. 16, the maximum production for the property was reached, with a heavy sprinkling of "colors" in every piece of rock, glistening in the sunlight. Appalling amounts of eloquence and newsprint were used in debating the question of ownership, the preponderant sentiment being in favor of the county. A not inconsiderable part of the local citizenry was inclined to be skeptical by virtue of certain sad experiences resulting from the discovery of oil in West Orange a few months ago, a discovery that netted only 3 fluid oz. of the fuel and that was later attributed to the presence of a garage in the vicinage.

Finally, John Murphy, who had been in charge of operations, decided to shut down, pending advice from headquarters as to whether he was excavating or mining. In due time the advice came, and a flourishing industry was cut off in its prime.

By many of the oldest inhabitants this is believed to be the first instance of gold-mining operations in East Orange. It may be remarked, however, that several miles to the east, in New York City, there are some very extensive gold diggings, from which an annual production that is not equaled even on the Rand is obtained.

## Mackay Metals Operating on Three-Shift Basis

INCREASING production from the Mackay Metals mine, near Mackay, Custer County, Idaho, has necessitated putting mill operations on a three-shift basis. This step increases the daily capacity to 150 tons of copper ore daily. A second unit of the mill, of equal capacity, which is now idle, may soon be brought into production. The mine was reopened in July, when the Mackay Metals Company acquired the entire holdings of the Idaho Metals Company, formerly the largest copper producer in Idaho. Since then production has gradually been increasing, and on Nov. 21 it was decided to put the property on the three-shift basis. About 20 men are employed in the mill and about 60 men in the mine. In addition 25 leasers are at work.

## Chichagof Mines Developing New Shear Zone

CHICHAGOF Mines, Ltd., of Vancouver, B. C., is getting satisfactory results from its development of the new shear zones recently discovered at the property on Chichagof Island, Alaska. The lenses of ore encountered in the shear zones are narrow, not exceeding 3 ft. in width. The mill is now operating intermittently on ore taken out in the course of development, mill heads averaging about $20 a ton. As soon as development has progressed sufficiently to provide necessary stoping ground, the mill will be operated on a full-time basis.

About 25 miners are employed at the property under the direction of J. L. Freeburn, who managed it in former days. The company has entered into a contract with Hirst-Chichagof Mining to supply its mine and mill with 200 hp. from its hydro-electric plant for a period of ten years, leaving Chichagof Mines with a surplus of 900 hp. for its own use.

## Portland Gold Closes Mill

The Independence mill of Portland Gold Mining at Victor, Colo., in the Cripple Creek district, was closed down on Dec. 1. It is an 800-ton plant. J. W. Ady, president of the company, states that decreased custom ores and reduced output from the Portland mine necessitated closing the plant. The mill will reopen subject to demand. It has handled mostly low-grade ore. Last year the company's operations were conducted at a loss.

## West Gold Builds New Mill

A new 75-ton cyanide mill is being constructed for West Gold Mining at Idaho Springs, Colo., by the Colorado Iron Works, of Denver. R. P. Atkins, of the construction company, is in charge of the work. The new plant will probably be ready for operations early in February. J. A. Hinds is president of the mining company.

## Install Equipment at Regal

At the Regal mine, in the Clark Fork district, Idaho, which is controlled by J. P. Delaney and C. I. White, president and manager of Whitedelf Mining, a Pelton water wheel is being installed to provide power for operation. Water is obtained through a 300-ft. flume and a 250-ft. pipe. An Ingersoll-Rand compressor is also being installed for use in mining operations. The company recently completed construction of a 3-mile road up Goat Mountain to provide transportation for the new equipment.

## Western Silica Builds Plants

Western Silica will build a grinding mill at Sacramento, Calif., for the preparation of ground silica from a deposit near Auburn, Calif. It also intends to grind other minerals.

# Annual Meeting of Canadian Institute in West Is Well Attended

*Addresses by Galloway and Stewart Point Out That Capital for British Columbia Mining Is Available, but That Scale of Production Possible Must Be Carefully Considered*

By T. A. Rickard
*Contributing Editor*

THE annual general western meeting of the Canadian Institute of Mining and Metallurgy was held at Vancouver, B.C., on Nov. 21 to 23. Registration was about 230. All the sessions, which were uniformly well attended, were held at the Hotel Vancouver. The president of the Western Division of the Institute, R. H. Stewart, was unfortunately absent, being detained on professional duties in Texas. John D. Galloway, the Provincial Mineralogist, presided at the opening session. First Mr. Stewart's address was read by the secretary, H. Mortimer Lamb. He gave a few salutary warnings as to carefulness of statement on the part of engineers concerning mining developments; declared that not many mines in the province were capable of a large production; and that this fact should be faced frankly in arranging the capitalization of companies to operate them. The public, on the other hand, was warned that more time is needed to bring a mine to the productive stage than is usually anticipated. Then Mr. Galloway, in his official capacity as Provincial Mineralogist, presented a review of mining affairs in British Columbia during the past year, and after him the six Resident Engineers gave similar reports, each dealing in turn with the developments and prospects in his own area. The engineers, speaking in the order of their numbered districts, were Howard T. James, Douglas Lay, H. G. Nichols, P. B. Freeland, A. G. Langley, and George A. Clothier. The manner and matter of these reports, that of Mr. Galloway himself and those of his six associates, were of a character to commend keen appreciation; the whole performance was highly creditable not only to the mining department of British Columbia, but to the mining engineering profession that these gentlemen so worthily represented.

Mr. Galloway remarked, "In the aggregate more extensive development of mineral properties throughout the province has been carried on in 1928 than in any previous year. It is quite noteworthy that a number of old properties have been taken up this year and fresh development commenced. Some of these were former producers and others are properties that have been partially developed and work stopped for various reasons. It has been the popular cry in recent years that all B.C. needed was more capital for mining. I have no hesitation in saying that there is plenty of capital now available. Consider, for instance, our four large mining companies, the Consolidated, Premier, Britannia, and Granby. Each has capital available for new mining enterprises. Yes, there is plenty of capital, but capital is careful and fastidious, and all prospects do not appeal as promising possibilities. But we are making good progress and hundreds of our prospects are being tried out. The result is that our prospectors, the small mining syndicates, and small companies can feel assured that once a promising prospect is shown, an abundance of capital will be available to carry it forward to production stage." Mr. Galloway strongly advocated more prospecting and urged mining engineers to encourage young men to go into this work.

## One Company Still at Work in Wahmonie

ONE company, Reorganized Booth Mining, is still operating in the Wahmonie silver-gold district of Nevada, where a strike was made last February that precipitated considerable excitement. The Booth company owns the site of the original discovery and has sunk a shaft 300 ft. Lateral work has shown the vein to contain small bunches of pay ore. The company has announced that the shaft will be continued to greater depth, depending on development results. About $6,000 has been spent for equipment and $15,000 in development work. Two other companies which hold adjoining territory are awaiting results from the Booth shaft.

At the official luncheon, given by the Vancouver Board of Trade, I delivered a short address on the miner as the pioneer of industry; and took the opportunity to pay a sincere compliment to the Provincial Mineralogist and his highly competent aides. It is a great thing for British Columbia that these officials should be appointed on merit and not as the henchmen of politicians; they are professional men detached from politics and assured of retaining their posts as long as they discharge their duties acceptably. This gives them a standing in the community, and the ability to check fraudulent mining operations.

The afternoon session on the first day was set aside for a discussion of coal mining, Dr. J. S. DeLury speaking for Manitoba and J. A. Richards for Alberta. Dr. DeLury referred also to the successful development of the Flin Flon mine, in which, he said, there was proved an orebody of 16 million tons, averaging 1.68 per cent copper, 3.49 per cent zinc, together with a little gold and silver. Dr. Victor Dalmage, representing the Geological Survey of Canada, described experiments made in the use of electrical prospecting, concerning which a report is to be issued soon. H. B. Lumsden, engineer for the Canadian Pacific Railway, spoke concerning the non-metallic resources of the prairie provinces; among the minerals exploited are sodium sulphate, lithia, silica sand, salt, and talc.

In the evening I gave a lecture to the members and others on "Minerals and Empire," reviewing the connection between the rise or decline of empires on the one hand and the expansion or contraction of mining on the other, from the days of the Athenian city-state to those of the recent war, which was decided mainly by the superior coal and iron resources of the Allied countries.

The morning session on Nov. 22 was devoted to the new oil fields of Alberta. Prof. M. Y. Williams, of the University of British Columbia, was in the chair. B. L. Thorne gave a sketch of the conditions under which oil, and, more importantly, gas are exploited on the eastern slope of the Rocky Mountains, in what is known as the Turner Valley oil field. The chief towns of Alberta (Edmonton, Calgary, and Medicine Hat) use this gas for domestic purposes, and have been doing so for many years. It is used also for industrial purposes, such as flour milling. There is talk of piping the gas to Great Falls, Mont., if the not unreasonable jealousy of the oil operators in that state does not block the scheme. Next, R. T. Banks gave a clear technical description of diamond-drilling methods as employed in the Turner Valley. Stress was laid on the remarkably high gas pressures encountered in the dolomitic limestone, namely, 3,500 to 4,000 lb. per square inch. The deepest bore is the Royalite No. 4, which struck gas at 5,400 ft. This yielded 20,000,000 cu.ft. of gas and 300 bbl. of naphtha per day when "brought in" four years ago. Last year the well yielded 6,000 bbl. of high-grade naphtha per day. The diamond drill was used after the standard rotary methods had failed, on account of the high pressures encountered. The rapid escape and expansion of the gas freezes the water in the well and plugs it effectively unless means are taken in time to prevent too sudden an emission of gas. Crude oil is used as the circulating medium in the bore. The gas, moreover, is readily ignited by friction unless great care be taken, and the extremely explosive character of this product is a constant menace. The final diameter of the diamond-drill hole is 4½ in. The Turner Valley oil field became productive in 1914, said S. G. Coultis. It is 42 miles southwest of Calgary, at an altitude of 4,200 ft., this fact being important in relation to air compression. The first discovery was based upon a gas seepage that was detected in a stream. Gas and oil were struck at

3,839 ft., the oil being used forthwith for cars and trucks in the district. The productive area now is about 8 miles by 1½ miles; 32 wells are producing at depths ranging from 2,160 to 5,900 ft. They are distributed along a rapidly pitching anticline, which demands keen geologic study.

At the luncheon, under the auspices of the Vancouver branch of the Institute, the speaker was Dean R. W. Brock, of the University of British Columbia. He emphasized the need for research in the use of the waste products of coal and the desirability of employing more technically educated men in that industry. He instanced the Slocan as an example of the rehabilitation of an old silver-lead mining district in consequence of the introduction of new methods by properly trained men. This point is made also in the current issue of the *British Columbia Miner*, to which I, as a veteran journalist, take pleasure in presenting my compliments. In its quiet style, in its fair spirit, and in the excellence of its English it does credit to the editors, among whom is numbered Mr. Mortimer Lamb, a conscientious exponent of the skillful use of our language.

Prof. J. M. Turnbull, also on the faculty of the local university, presided admirably at the afternoon session, which was given to the discussion of the mining methods employed in the bigger mines of the province. J. I. Moore gave an abstract of his paper on the methods in vogue at the Britannia mine; he outlined the variety of conditions under which the copper orebodies exist in the schist of Howe Sound and the consequent need for varying the system of mining. The cost is 20c. per ton of ore broken. This speaks for itself. Then Ralph Healy described practice at the Hidden Creek mine of Granby Consolidated, among other matters mentioning the fact that freshly broken ore is more amenable to flotation treatment than ore that has become slightly oxidized while lying broken in the stopes. Gordon Thompson discoursed clearly on mining methods at the Sullivan mine. E. Ebutt gave a paper on the precipitation of copper from the mine waters of the Fairview workings of the Britannia mine.

The last morning was given to papers on the treatment of Slocan ores, by H. Van Smith; the geology of the Topley area, by T. C. Phenister; and the geology of the Portland Canal district, by R. Hodson. The afternoon session was signalized by a discussion of desirable revisions of the Placer Mining Acts, the subject being introduced by A. M. Whiteside. Papers on the milling practice of the Premier mine, by the manager, Dale L. Pitt; and another on the mining methods of the Chichagof mine, in Alaska, by G. T. Jackson, were discussed.

The annual dinner, which I was unable to attend, was graced by the presence of the Lieutenant-Governor, R. R. Bruce; the Premier, S. F. Tolmie; and the Minister of Mines, W. A. McKenzie; which reminds me that Mr. G. C. Mackenzie, the secretary of the Institute, received a warm welcome, as did Dean Milnor Roberts of the University of Washington. Among other veterans not mentioned as yet in my account of the meeting, but contributing to its interest and character, were Messrs. Nichol Thompson, S. S. Fowler, Gomer P. Jones, W. Fleet Robertson, C. P. Hill, Charles H. Bocking, F. W. Guernsey, Chester F. Lee, and Louis Stockett. Among the younger men it was a pleasure to me to meet R. C. Rowe, editor of the *Canadian Mining Journal*, and Prof. Joseph Daniels, of the University of Washington.

By way of summary, it may be said that the meeting was as informing as it was sociable, and admirably served to accomplish its purpose: the exchange of ideas and the furthering of friendships.

## Work Resumed in the Old Boundary District, B. C.

THE rise in the price of copper has turned the attention of mining men and speculators once again to the Boundary district of British Columbia, which when the Phoenix and Greenwood mines were at their peak of activity, and the old Grand Forks and Greenwood smelters were in full operation, was the chief mining center of the Province.

The most ambitious scheme under way at the present time is one started by R. Crowe Swords and associates, and said to be backed by British capital, the exact source of which has not been revealed. It includes the formation of two companies—Crescent Mines and Hercules Consolidated Mining, Smelting & Power. The former is to be a holding company, to continue the driving of the main haulage tunnel from Grand Forks to Phoenix, a distance of three miles, which was started twenty years ago, but discontinued after it had been driven about 3,000 ft. The tunnel will gain depth as it is advanced, until at Phoenix it will have a depth of more than 1,000 ft., and will crosscut the vein system of several mines that have been worked profitably at the surface and for shallow depths. At Phoenix it is proposed to sink a shaft to connect with the tunnel. As the old mines are opened at depth by the tunnel, subsidiary companies are to be formed to develop them. Mr. Swords has obtained options on more than 200 claims and still is seeking claims in the district. The Hercules company is to be associated with the Crescent as a treating company, to concentrate and smelt ores. Its capital is said to be owned entirely in Great Britain, and no local capital will be sought. It has entered into an agreement with the city of Grand Forks, whereby, in consideration for the expenditure of not less than $1,000,000 in improvements, the city will transfer to the company title on the old Granby smelter site, lake and power rights. There is a clause allowing time for the further experimenting on the old slag dumps, containing some 12,000,000 tons, which the company expects to be able to utilize, though for what purpose is not known. The slag is said to contain between 50 and 53 per cent of iron and around 0.2 per cent of copper.

Pacific Tidewater Mines, which is backed by British Metal Corporation, and C. F. Law, of Vancouver, acting for British interests, has also bonded several properties around Phoenix and Greenwood, and Granby Consolidated Mining, Smelting & Power has had its engineers surveying its holdings in the district. The Granby company was said to have some 600,000 tons of low-grade ore in its Phoenix mines at the time that they were closed, about seven years ago, but they were closed prematurely because of a strike in the Crow's Nest Pass coal field, which made it impossible to get coke, all the ore at that time being treated by semi-pyritic smelting.

## Butte Mine Makes Record for Quick Production

APPROXIMATELY 4,000 tons of ore have been mined during the last two months by Ardsley Butte Extension Mining at its property, southwest of Butte, Mont., according to John A. Roos, manager of the company. The organization was formed only six months ago to take over the Goldstream claim, which adjoins the Highland mine of Ardsley Butte Mining on the east. Since then a two-compartment shaft has been sunk to a depth of 165 ft. and an electrically operated compressor installed. Crosscuts were driven and struck an orebody, which has since been proved to extend 300 ft. and average 6 ft. in width.

The company has paid for its property and has only current bills owing. The profit on the ore shipped to the Timber Butte mill thus far has been $35,000. Ore is chiefly silver, with some lead and zinc. About 60 men are now employed at the property. Shaft sinking is being continued under contract.

## Appeal of Iron Ore Companies Dismissed by Supreme Court

THE consolidated appeal of the Vermillion Mining Company, the Crete Mining Company, and the Inland Steel Company, protesting against being taxed as lessees for royalties paid, has been dismissed by the United States Supreme Court on the authority of its decision in the case of the Lake Superior Consolidated Iron Mines versus Lord. The brief submitted in behalf of the mining companies contends that the royalty tax imposed on iron ore extracted is a tax on the income of the land and not assessed upon the land itself. It is argued, therefore, that payment of the royalty tax does not come under the provisions of the covenants of the leases by which the lessees agree to pay all taxes assessed against the land. The brief also protests that the tax does not operate uniformly upon all the lands within the classification, since it is imposed only on lands leased for royalties.

# Toronto Letter

*By Our Special Correspondent for Northern Ontario*

## Developments at Noranda on 500 and 600 Levels Are Resulting Favorably

TORONTO, ONT., Dec. 1, 1928—Development results on the 500 and 600 levels of Noranda Mines, in the Rouyn district, Quebec, have shown an improvement over those obtained at 400 ft., which were not so good as at 300 ft. Nothing particularly new has been developed in regard to the H orebody, the opening up of which in the early summer was the center of interest in Noranda activities, and nothing of any consequence is expected to be known of this orebody below the 975 level until the completion, some time in 1929, of the new 1,000-ft. shaft, now being sunk north of the No. 3 or main shaft. The smelter is handling between 900 and 1,000 tons of ore a day. It averages 7 per cent copper and $4 in gold. Gross production is valued at about $650,000 a month, from which a profit of $400,000 a month, before depreciation, is being realized.

AT THE Aldermac property, in the same district, a 15-ft. width of 6 per cent copper ore has been discovered on the 500 level. This property is controlled by Noranda. Drifts are being driven east and west, and if this ore shows continuity, the mine will assume an entirely different aspect. Until the discovery of this new ore, Aldermac had been considered as primarily a low-grade copper property. Diamond drilling is being done on the 750 level to pick up the downward extension of the new find and crosscuts are also being driven on the 1,125 level.

It is understood that a revision of concentrator charges is to be made to the Waite-Montgomery property, also controlled by Noranda. This revision results from the fact that the mine is now shipping higher grade ore to the Noranda concentrator.

Central Manitoba Gold Mines has decided to increase its milling capacity from 160 to 250 tons a day. The property is in the Rice Lake area. This step is being taken, apparently, as an alternative to re-financing. On the present operating basis the company has been able to show moderate profits, but because of transportation difficulties, a large amount of cash is needed during the winter to provide funds for the year's supply of provisions, which must be brought in during the winter. Production at present is at the rate of about $50,000 a month.

At Amity Copper, in the Boston Creek district, near Kirkland Lake, northern Ontario, the main shaft is being sunk from 250 to 600 ft. A new hoist will be installed capable of working to a depth of 1,000 ft. Lateral work on the 375 level, conducted through the winze, has been completed, with good results. The orebody is believed to be dipping toward the north, but no further attempt will be made to reach it until the shaft attains its objective. Eight shipments of ore have been made to the Noranda smelter to date.

## Cornish Tin Mine Increases Milling Capacity

THE Wheal Kitty tin mine—originally one of a group of prosperous Cornish properties and now being opened up by Anglo-Oriental interests—has increased its milling capacity to 3,000 tons per month as a result of promising mine developments which indicate the continuance of the main lodes at depth. A new development scheme recently initiated is expected to provide reserves for three years by the end of 1929. Additional capital has been provided, and, although comparatively low-grade ore will at first be milled, operations are expected to show a profit by the end of the current year.

## Dutch and English Tin Companies to Explore Uganda

NEGOTIATIONS which have been proceeding for some months were recently concluded by the signing of an agreement between the leading Dutch tin group—the Billiton Company—and the Tanganyika Goldfields and its Ankole, Bukoba, and Kagera tin subsidiaries. An exploration company has been formed to prospect the areas in Tanganyika and Uganda controlled by these four companies, subject to each retaining the tin deposits which it is already working. A prospecting party, which will include nine Billiton engineers, will probably sail for East Africa next month. The areas mentioned in the foregoing were previously under option to the London Tin Syndicate (Anglo-Oriental group), but were abandoned by it earlier in the year.

## Yellow Pine Group Bought

Wood River Mining is the name of a new company, formed by Conrad Wolfle, of Spokane, and associates, to operate the Yellow Pine group of claims in the Wood River district, Idaho. The properties are 7 miles north of Ketchum, the nearest railroad station. According to Mr. Wolfle, power for a compressor will be developed and development work started as soon as possible. The purchase price was $100,000. The properties carry silver-lead ore.

## Equip Russian Copper Mines

The Degtiarka copper mines, in the Urals Concession, are being equipped with a concentrating plant, concentrate from which it is hoped will yield 3,000 tons of copper next year and 12,000 tons per annum subsequently. In the Altai Concession, complex-ore mines are also being developed.

# Mexico City Letter

BY W. L. VAIL
*Special Correspondent*

## History of El Oro District Rapidly Draws to a Close—Another Mine Suspends

MEXICO CITY, NOV. 26, 1928—The final chapter in the history of the famous old gold camp of El Oro, in the states of Michoacan and Mexico, Mexico, is being written rapidly. The latest mine to suspend operations is the Carmen de las Virgenes, owned by Borda Antigua y Anexas, a property that has been worked almost continuously for more than 200 years. Its owners have advised the mining division of the Department of Commerce, Industry and Labor of their intention to close down as soon as present ore reserves are exhausted, a matter of a few months. The property has been operated, under contract, by Las Dos Estrellas. The latter company, which holds property of its own in the district, is still employing about 3,000 men on old fills and is mining about 2,000 metric tons daily. Mexico Mines of El Oro has made another reduction in the number of workmen employed.

AFTER Jan. 1, 1929, all quotations in Mexico involving the conversion of foreign monetary units must be made in Mexican pesos. Decimals must be used in place of fractions. The purpose of this measure is to avoid confusion and errors in conversion. Obligations incurred in Mexico to be paid in foreign coin or currency may be liquidated on the basis of exchange for Mexican currency, at quotations fixed by local authorities.

Operations by small companies are reported to be on the increase in the State of Sonora. In the Yaqui district, between Cocorit and Buenavista, several new properties are being actively worked. The present governor of Sonora, General Topete, is extremely liberal in his attempts to encourage mining and is personally interested in a number of well-known properties. The San Luis mine, an old property, has recently been reopened in the municipality of Trincheras, in the Altar district, and about 50,000 pesos' worth of machinery has been installed. The mine is now owned by mining men from Guaymas, Sonora.

A report has been received from Guerrero that the old Garduno mine, near the Balsas River, has been optioned by California mining men. An automobile road to connect with the Balsas River and ultimately with the main highway from Mexico City to Acapulco, on the Pacific Coast, is planned by the new owners. The Garduno was formerly worked by a British company and was a large producer in the 'nineties.

# MARKET AND FINANCIAL NEWS

## A New Brass Merger Being Formed

RUMORS that the American Smelting & Refining Company and the Phelps Dodge Corporation each were planning to become large factors in the copper-manufacturing field received partial confirmation this week in the report from Rome, N. Y., that the directors of the Rome Brass & Copper Company had approved a plan to merge with six other companies, forming a consolidation to be known as the General Brass Corporation. The constituent companies are said to be the Taunton-New Bedford Copper Company, of Taunton and New Bedford, Mass.; the Baltimore sheet mill of the General Cable Corporation; the Rome Manufacturing Company; the Dallas Brass & Copper Company, Chicago; the Higgings Brass & Manufacturing Company, of Detroit; and the Michigan Brass & Copper Company, also of Detroit. Control of the last-named company was purchased by the American Smelting & Refining Company two or three months ago, and it is understood that the A. S. & R. has an important interest in the General Cable Corporation. It is said that Kissel, Kinnicutt & Company is the investment house interested in the consolidation.

Acquisition of brass and wire companies by the Phelps Dodge interests is not so far along, but well informed opinion is to the effect that certain options will expire about the end of the year. The Bridgeport Brass Company and the Bristol Brass Corporation are mentioned in this connection. Some talk of the Chase Brass & Copper Company having been approached has also been heard, but it is said that the property is being held for $50,000,000, or $5,000,000 more than Anaconda paid for American Brass, which may or may not be attractive. Foster McConnell & Company are said to be behind this move.

## STATISTICAL NOTES

HECLA MINING COMPANY, Cœur d'Alene silver-lead producer, reports net profit of $272,931 for the third quarter of 1928, as against $348,638 in the second quarter of 1928. Production in the third quarter amounted to 391,447 oz. silver and 6,677 tons of lead, comparing with second-quarter production of 449,391 oz. silver and 7,574 tons of lead. A total of 80,065 tons of ore was mined in the second quarter, against 76,665 tons in the third quarter.

SANTA GERTRUDIS COMPANY, LTD., reports for the quarter ended Sept. 30, 1928, a total of 170,801 tons of ore milled. Total Santa Gertrudis, Inversiones and Dos Carlos revenue, allowing for development and participation of owners but before deducting for depletion or depreciation, was $483,251.

LAKE SUPERIOR iron-ore shipments for the season to Oct. 31, 1928, totaled 49,719,931 tons, against 49,110,133 tons for the corresponding period last year.

PATINO MINES & ENTERPRISES CONSOLIDATED, INC., Bolivian tin producer, for nine months ended Sept. 30, 1928, reports net profit of $3,584,358 after depreciation, depletion, interest and taxes, equivalent to $2.59 a share earned on 1,380,316 shares of stock. This compares with $3,302,525 or $2.39 a share in first nine months of 1927.

UTAH-APEX MINING COMPANY reports for year ended Aug. 31, 1928, profit of $65,316 after expenses and depreciation, but before depletion and federal taxes, compared with profit of $367,202 in preceding year. Production for the year ended Aug. 31 compares with that for the preceding year as follows:

| | 1928 | 1927 |
|---|---|---|
| Lead, pounds | 23,895,342 | 27,516,000 |
| Zinc, pounds | 10,473,535 | 9,058,041 |
| Copper, pounds | 4,766,556 | 6,426,878 |
| Silver, ounces | 494,599 | 611,866 |

ALASKAN PRODUCTION of gold and copper showed a decided improvement in value for October. Gold output was the highest in two years and the copper output the highest for the last twelve months. The following are the values filed with the United States Customs Office at Juneau for October, 1928, with comparative statement for the corresponding month of 1927:

| Metal | 1927 | 1928 |
|---|---|---|
| Gold | $1,071,822 | $1,464,591 |
| Silver | 50,167 | 36,366 |
| Copper | 1,277,711 | 921,390 |
| Lead | 10,271 | 10,012 |
| Totals | $2,409,971 | $2,432,359 |

AHUMADA LEAD COMPANY reports net loss of $118,128 for the first nine months of 1928.

ZONOLITE COMPANY, operating a vermiculite mine and treatment plant at Libby, Mont., reports the shipment of 478,599 lb. of "Zonolite," valued at $7,025, in 1927, compared with 225,050 lb., valued at $3,447, in 1926. The company plans to increase the scope of its operations in the near future. "Zonolite" finds utilization at present as a packing for safes, vaults, and filing cabinets; in grease making; as a house insulation; as an electrical insulation; in decorative wallpaper; in wall plaster and kalsomine; as a substitute for cork; and as a packing for electrical baking ovens.

## London Financial News

BY DONALD J. FARQUHARSON
*Special London Correspondent*

LONDON, Nov. 20, 1928—The Whitworth Finance & Mining Corporation was floated here yesterday with a capital of £350,000. This is the company which is to develop the Queensland (Australia) tin mines mentioned in last week's London news. Its policy is to acquire selected mining properties and float them as separate concerns. Beyond the previously mentioned Queensland tin mines, the company has acquired an option on a tin area in S. W. Africa and the Engineer Creek alluvial gold areas in Fairbanks, Alaska, adjoining the Goldstream properties of the Fairbanks Exploration Company (subsidiary of the U. S. Smelting Refining & Mining Company), which is equipped with two dredges. The Queensland mines are expected to produce 340,000 tons of ore (ranging from 1 to 3.6 per cent tin) per annum within four years. The African property is expecting to produce 300 tons daily of 1.5 per cent ore, and the Alaskan area, 4,000 cu.yd. of ground daily. Amor F. Keene, of New York, is the company's American consultant.

Cam & Motor, Rhodesia's most profitable gold mine, continues to open up good ore at depth in all three lodes, the Cam, Motor, and Petrol. The addition of sixteen Nissen stamps to the mill brought the tonnage treated for the year ended June 30, 1928, to the record of 260,000 tons. The grade was 45s. per ton, and the profit 22s. Arsenic continues to give trouble, apparently, for the gold extraction was only 82.7 per cent. Reserves are higher at 1,093,300 tons valued at 53s. 7d. per ton. Last year's working profit was £11,487 greater, at £285,432, and the dividend was unchanged at 30 per cent.

Sir Ernest Birch, chairman of the Eastern Smelting Company (which held its general meeting during the week), draws a very encouraging conclusion from the robustness shown by the tin-consuming industries, and regards the future with confidence. That production has recently exceeded consumption, he says, is a perfectly normal consequence of the high prices caused by the inverse position which obtained for some time previously. The industry must pass through a period of readjustment before world consumption catches up and equilibrium between supply and demand is restored. Sir Ernest is of opinion that, considering the great advances made in recent years, the scope for further improvement in tin-smelting practice is consequently narrowed.

## Teck-Hughes Report Shows High Rate of Earnings

TECK-HUGHES Gold Mines, Ltd., operating in the Kirkland Lake district of northern Ontario, milled 276,652 tons of ore during the fiscal year ended Aug. 31, 1928. Gross bullion return amounted to $4,504,707, equivalent to $16.28 per ton of ore. Profit-and-loss details are shown in the accompanying table:

**Operating and Profit-and-Loss Account**

| | | |
|---|---|---|
| *Revenue* | | |
| Bullion production | $4,504,706 | |
| Interest and exchange | 79,736 | $4,584,442 |
| *Expenditure* | | |
| Development and exploration | $245,673 | |
| Mining | 715,988 | |
| Milling | 410,186 | |
| General expense | 188,601 | |
| Depreciation on buildings and fixed plant | 187,481 | 1,747,929 |
| Net operating profit for year | | $2,836,512 |
| Provision for federal and provincial taxes | | 219,019 |
| Net surplus for year | | $2,617,493 |

A total of $180,621 was expended on plant additions during the year and charged to capital account. The pilot plant in connection with the new mill was completed in December, 1927, and operated intermittently until March, using flotation in conjunction with cyanidation. Results were not completely satisfactory, so the flotation equipment was discarded in April and replaced by additional cyanidation equipment.

Summarized operating costs are shown in the accompanying table:

**Summarized Operating Cost Statement**

| | Total cost | Cost per Ton of Ore Treated | Cost per Ounce of Gold Produced |
|---|---|---|---|
| Development and exploration | $245,673 | $0.89 | $1.13 |
| Mining | 715,988 | 2.59 | 3.29 |
| Milling | 410,186 | 1.48 | 1.88 |
| General expense | 188,601 | 0.68 | 0.86 |
| Total direct charges | $1,560,448 | $5.64 | $7.16 |
| Depreciation | 187,481 | 0.68 | 0.86 |
| Total charges | $1,747,929 | $6.32 | $8.02 |

The relatively insignificant value of the silver in the bullion has been considered, for the above purposes, as equivalent gold.

ONTARIO MINERAL PRODUCTION for 1928 will amount to a value of $100,000,000, according to the Canadian Department of Commerce. This figure represents an increased production of $10,000,000 over the 1927 output. The increase is accounted for chiefly by the development of the copper-nickel industry which has centered principally in the Sudbury district. Gold production this year will show a slight increase over 1927, but silver will show a small decrease, it is expected.

LECLAIR MINES COMPANY, of which John Tait Milliken and J. L. Nichols, of Colorado Springs, are president and secretary-treasurer, respectively, has assumed the debts of the Mary McKinney Company and thus acquired control of the property. Stockholders of Mary McKinney will be offered one share of LeClair Mines for ten shares of the Mary McKinney stock.

ANGLO-CANADIAN EXPLORERS (1927) LTD., largely interested in the Central Manitoba Mines Company of Canada, reports productive operations at that property are reaching a satisfactory basis, following the usual difficulties incurred during early operation of a new plant. For August, 1927, a total of 4,283 tons of ore was treated, yielding a gross return of $40,264. Development work, though restricted, has added to the ore reserves, which were estimated at 141,000 tons in April of this year, with a gross valuation of roughly $1,500,000. The Anglo-Canadian Company has an interest in the Gull Lake and Kirkland Townsite operating companies, also. Drilling and prospecting of these properties to determine the extent and character of ore occurrence are under consideration.

BROKEN HILL PROPRIETARY COMPANY, LTD., reports net profit of £222,617 for the fiscal year ended May 31, 1928.

## Imports and Exports of Ores and Metals in October, 1927 and 1928

Compiled from U. S. Department of Commerce Records

*In Pounds, Unless Otherwise Stated*

### Imports

| | October 1927 | October 1928 |
|---|---|---|
| Antimony | | |
| Ore—Gross weight | 481,314 | 873,448 |
| —Antimony content | 244,174 | 450,050 |
| Copper | | |
| Ores, copper content | 6,999,850 | 8,171,439 |
| Concentrates, copper content | 2,058,527 | 3,493,570 |
| Regulus, coarse metal, cement copper | 176,850 | 110,500 |
| Imported from | | |
| Spain | 653,994 | 1,071,903 |
| Canada | 4,096,927 | 5,891,410 |
| Mexico | 3,695,254 | 2,105,654 |
| Cuba | ..... | 1,601,400 |
| Chile | 672,218 | 832,835 |
| Peru | ..... | 56,811 |
| Other countries | 116,834 | 215,496 |
| Unrefined black converter copper in pigs, bars, and other forms | 37,296,679 | 54,213,116 |
| Refined copper | 6,050,483 | 9,278,160 |
| Old and clippings for remanufacture | 718,419 | 1,154,976 |
| Composition metal, copper chief value | ..... | 8,960 |
| Brass, old, for remanufacture | 442,540 | 1,290,181 |
| Lead | | |
| Ore and matte, lead content | 4,831,218 | 4,211,625 |
| Bullion or base bullion | 18,859,589 | 26,481,871 |
| Pigs and bars | 261,568 | 5,975 |
| Babbitt, solder and other forms, lead content | 157,755 | 79,111 |
| Type metal, antimonial lead: Gross weight | ..... | 941,088 |
| Type metal, antimonial lead: Lead content | ..... | 730,210 |
| Manganese, tons | | |
| Cuba, manganese content | 176 | 111 |
| Other countries, manganese content | 14,780 | 26,031 |
| Pyrites, tons | 24,935 | 44,686 |
| Tin | | |
| Ore, tons | 16 | 6 |
| Bars, blocks, pigs | 16,080,871 | 18,027,677 |
| Imported from | | |
| United Kingdom | 1,931,322 | 848,713 |
| Netherlands | 1,120,208 | 2,197,168 |
| British Malaya | 12,820,433 | 14,507,608 |
| Netherland East Indies | ..... | 115,225 |
| China and Hongkong | 27,510 | 33,893 |
| Australia | 100,800 | 112,020 |
| Other countries | 80,598 | 213,049 |
| Zinc | | |
| Ore, zinc content: Free, less 10 per cent zinc | ..... | ..... |
| Ore, zinc content: Dutiable | ..... | 182,392 |
| Blocks, pigs and old | 9,270 | 703 |

### Exports

| | October 1927 | October 1928 |
|---|---|---|
| Copper | | |
| Ores, composition, concentrates, unrefined | 545,390 | 5,200 |
| Refined copper in ingots and other forms | 74,482,032 | 76,295,470 |
| Exported to | | |
| Belgium | 7,812,212 | 4,230,477 |
| France | 9,987,742 | 19,699,313 |
| Germany | 13,972,880 | 20,919,076 |
| Italy | 5,460,223 | 6,646,485 |
| Netherlands | 8,070,078 | 3,453,098 |
| Spain | 148,205 | 292,280 |
| Sweden | 2,267,635 | 2,002,818 |
| United Kingdom | 17,263,249 | 15,046,828 |
| Other Europe | 7,539,745 | 987,221 |
| Canada | 1,199,093 | 1,204,443 |
| China, Hongkong, Kwantung | 114,323 | 49,280 |
| Japan | 335,939 | 1,007,814 |
| Other countries | 310,708 | 756,337 |
| Old and scrap | 2,762,536 | 5,611,264 |
| Pipes and tubes | 212 508 | 311 408 |
| Plates and sheets | 308,665 | 421,052 |
| Rods | 4,446,995 | 5,798,305 |
| Insulated copper wire and cable | 1,020,312 | 1,844,471 |
| Lead | | |
| In pigs, bars and other forms | 22,896,704 | 20,895,732 |
| From foreign ore | 22,825,569 | 17,973,792 |
| From domestic ore | 71,135 | 2,921,840 |
| Exported to | | |
| Belgium | 224,042 | 112,024 |
| France | 3,697,246 | 224,097 |
| Germany | 2,520,742 | 2,924,159 |
| Netherlands | ..... | 571,387 |
| Sweden | 705,882 | 1,423,005 |
| United Kingdom | 11,203,888 | 9,746,113 |
| Other Europe | 589,456 | 1,512,509 |
| Beazil | 324,867 | 291,350 |
| Other South America | 94,575 | 76,684 |
| China, Hongkong, Kwantung | ..... | 1,008,737 |
| Japan | 3,361,502 | 2,801,265 |
| Other countries | 174,504 | 204,402 |
| Other lead manufactures | 480,534 | 1,580,976 |
| Zinc | | |
| Ores and concentrates, tons | 1,722 | ..... |
| Dross | 455,466 | 180,924 |
| Cast in slabs, blocks and pigs | 9,880,701 | 1,767,723 |
| Exported to | | |
| Belgium | 56,000 | ..... |
| France | 854,957 | 448,064 |
| Germany | ..... | 472,407 |
| Italy | 336,189 | ..... |
| Netherlands | 109,628 | 151,574 |
| United Kingdom | 4,258,013 | 112,055 |
| Other Europe | 1,100 | 168,436 |
| Argentina | 964,318 | ..... |
| Japan | 3,191,403 | 112,020 |
| Other countries | 109,093 | 303,167 |
| Sheets and strips, other forms | 630,267 | 979,411 |
| Dust | 462,630 | 38,812 |
| Other zinc manufactures | 219,105 | 167,584 |

# The Market Report

## Lead Price Advanced to 6½c.

*New York, Dec. 5, 1928*—An advance in the price of lead from 6.35c. to 6.50c., New York basis, accompanied by heavy buying on one or two days, has been the only outstanding feature of a very quiet week in the non-ferrous metal markets. Sales of copper have been the smallest in several months. The zinc price is firmly established at 6.35c., though buying has slackened considerably since the first of the month. Tin advanced to 53¼c. on Monday, the highest price in several months, but experienced a sharp decline, subsequently.

### Quiet Week in Copper

Domestic copper business during the past week has been in small volume, the smallest in fact in nearly four months. Improved export demand has largely offset the dearth of domestic sales. Settlement of the labor disturbances in Germany has been a big factor in bringing Europe back into the copper market. Foreign sales to date are at the rate of approximately 2,000 tons per day. February delivery continues to be specified on the bulk of the domestic business. Prompt and December have been in better than average demand, and a fair proportion of the total has been for March shipment. Uncertainty resulting from the various merger rumors undoubtedly is keeping a number of fabricators out of the market.

### Lead Sells in Good Volume as Price Advances

An advance in the price of spot lead in London last Friday, coupled with the continued strong domestic demand, resulted in an advance in the contract price of the A.S.&R. Company from 6.35 to 6.50c. per pound on Monday, Dec. 3. Business at the higher level had been done by some producers as early as last Friday, however. As a result a large number of inquiries accumulated in the hands of the various sales agencies pending the advance, and were filled at the higher price, particularly by one or two producers who did not open their books for January lead until Monday.

Speculators and dealers appear to think the price is going higher, for they have paid as high as 6.40c. per pound for round-tonnage lots for January shipment, though these transactions have been offset by one or two sales below the prices quoted for chemical lead in East St. Louis on Monday and Tuesday. Cable manufacturers continue to dominate among the consuming interests in the market. Corroding lead has sold in better than usual volume for this time of year.

### Average Metal Prices for November, 1928

| | |
|---|---|
| COPPER: | |
| New York Electrolytic | 15.778 |
| London Standard Spot | 68.080 |
| London Electrolytic Spot | 74.750 |
| LEAD: | |
| New York | 6.389 |
| St. Louis | 6.222 |
| London Spot | 21.239 |
| London Forward | 21.469 |
| SILVER: | |
| New York | 57.953 |
| London | 26.704 |
| Sterling Exchange | 484.492 |
| ZINC: | |
| St. Louis | 6.263 |
| London Spot | 24.801 |
| London Forward | 24.827 |
| TIN: | |
| Straits | 50.750 |
| London | 232.875 |
| QUICKSILVER | 123.000 |
| ANTIMONY | 10.109 |
| PLATINUM: | |
| Refined | 76.417 |
| Crude | 66.417 |
| ALUMINUM 99 PER CENT PLUS. | 24.300 |

### Daily Prices of Metals

| Nov. Dec. | Electrolytic Copper | Straits Tin | Lead | | Zinc |
|---|---|---|---|---|---|
| | Refinery | New York | New York | St. Louis | St. Louis |
| 29 | Holiday | ..... | ..... | ..... | .... |
| 30 | 15.775 | 52.875 | 6.375 | 6.25@6.275 | 6.35 |
| 1 | 15.775 | 52.875 | 6.375 | 6.25@6.275 | 6.35 |
| 3 | 15.775 | 53.25 | 6.50 | 6.30@6.35 | 6.35 |
| 4 | 15.775 | 52.50 | 6.50 | 6.325@6.375 | 6.35 |
| 5 | 15.775 | 51.50 | 6.50 | 6.35 | 6.35 |
| | 15.775 | 52.600 | 6.450 | 6.310 | 6.350 |

Average prices for calendar week ending Dec. 1, 1928, are: Copper, 15.775; N. Y. Straits tin, 52.800; N. Y. lead, 6.360; St. Louis lead, 6.230; zinc, 6.333; and silver, 57.800.

**The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.**

**Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.**

**In the trade, copper prices usually are quoted on a delivered basis: that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.**

**Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.**

**Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.**

**Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.**

### London

| Nov. Dec. | Copper | | | Tin | | Lead | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|
| | Standard | | Electrolytic | Spot | 3M | Spot | 3M | Spot | 3M |
| | Spot | 3M | | | | | | | |
| 29 | 68 7/16 | 68 7/8 | 74 3/4 | 239 1/4 | 237 1/2 | 21 11/16 | 21 15/16 | 26 5/16 | 26 9/16 |
| 30 | 68 1/2 | 69 1/16 | 74 3/4 | 239 7/8 | 238 1/4 | 21 3/4 | 22 | 26 3/8 | 26 5/8 |
| 3 | 68 11/16 | 69 1/8 | 74 3/4 | 241 1/2 | 239 1/2 | 21 3/4 | 22 1/16 | 26 1/16 | 26 7/16 |
| 4 | 68 9/16 | 68 15/16 | 74 3/4 | 239 | 237 1/4 | 21 5/8 | 21 15/16 | 26 1/16 | 26 5/16 |
| 5 | 68 1/4 | 68 5/8 | 74 3/4 | 232 5/8 | 231 1/2 | 21 7/16 | 21 3/4 | 26 1/16 | 26 3/8 |

**The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.**

### Silver, Gold, and Sterling Exchange

| Nov. Dec. | Sterling Exchange "Checks" | Silver | | Gold London | Dec. | Sterling Exchange "Checks" | Silver | | Gold London |
|---|---|---|---|---|---|---|---|---|---|
| | | New York | London | | | | New York | London | |
| 29 | Holiday | .... | 26 5/8 | 84s11½d | 3 | 4.84 5/8 | 57 3/4 | 26 9/16 | 84s11½d |
| 30 | 4.84 5/8 | 57 3/4 | 26 9/16 | 84s11½d | 4 | 4.84 5/8 | 57 1/2 | 26 1/2 | 84s11½d |
| 1 | 4.84 5/8 | 57 7/8 | 26 9/16 | ..... | 5 | 4.84 5/8 | 57 5/8 | 26 1/2 | 84s11½d |
| | | | | | | Ave. | 57.700 | | |

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

## Zinc Market Quieter After Active Buying Period

With the price of Prime Western zinc firmly established at 6.35c. per pound in East St. Louis, and galvanizers seemingly well covered for a considerable proportion of their first quarter of 1929 business, the market since Dec. 1 has been much quieter. Nevertheless, the sales tonnage for the week is about 300 per cent of normal.

## Tin Reacts After Rapid Advance

Features of the tin market during the past week have been the opening of the new National Metal Exchange on Monday, and the decline in prices yesterday and today following weakness in the London market. A new high for the current movement was recorded at 53¼c. on Monday, though today the price is below 52c. The market appears fundamentally unchanged, with future tendencies depending entirely on the attitude of the dominant bull group in London.

## Silver Quiet; Market Weak

During the past week the silver market continued quiet, with small volume. Prices eased off slightly, due more to absence of buyers than from pressure to sell. China has apparently absorbed the small offerings made in the market, as India has shown no interest at the present level.

*Mexican Dollars* (Old Mexican pesos): Nov. 29th, holiday; 30th, 43⅝c.; Dec. 1, 43¾c.; 3d, 43⅝c.; 4th, 43⅜c.; 5th, 43½c.

## Foreign Exchange

Closing cable quotations on Tuesday, Dec. 4, were: Francs, 3.90½c.; lire, 5.23¾c.; and marks, 23.83¼c. Canadian dollars, ⅛ per cent discount.

## Large Tonnage of Zinc Ore Sold

*Joplin, Mo., Dec. 1, 1928*

| Blende | Per Ton |
|---|---|
| High | $42.50 |
| Premium blende, basis 60 per cent zinc | $40.00@ 41.00 |
| Prime Western, basis 60 per cent zinc | 39.00@ 40.00 |
| Fines and slimes, 60 per cent zinc | 36.00@ 38.00 |
| Average settling price, all zinc | 39.89 |
| **Galena** | |
| High | $86.10 |
| Basis 80 per cent lead | 85.00 |
| Average settling price, all lead | 83.60 |

Shipments for the week: Blende, 14,916; lead, 1,785 tons. Value, all ores the week, $744,330.

Purchasing agents today contracted for 22,360 tons of zinc ore. Added to the 15,330 tons purchased last week, the shipment of this total tonnage will remove approximately 14,000 tons of reserve ore. Salable stocks may rightfully be estimated now at 30,000 tons—less than three weeks' output. Replenishing depleted stocks at the smelters while the weather continues favorable for loading and shipping will make unnecessary shipments of ore later, when it would have to be blasted from the bins.

Offers of $85 basis for lead ore were renewed today. One buyer has not ceased settlements on that basis, and sales on the $82 basis were small. Holders of reserve stocks are expecting a higher price level early in the new year, and have declined to accept $85. Current production will largely be sold.

*Platteville, Wis., Nov. 24, 1928*

| Zinc Blende | Per Ton |
|---|---|
| Blende, basis 60 per cent | $42.75 |
| **Lead Ore** | |
| Lead, basis 80 per cent | $82.00 |

Shipments for the week: Blende, 832 tons; lead, 40 tons. Shipments for the year: Blende, 33,920 tons; lead, 1,770 tons. Shipments for the week to separating plants, 1,172 tons blende.

## Steel at New Record in 1928

*Pittsburgh, Dec. 4, 1928*

The general volume of steel buying tapered off somewhat more in November, partly as a normal seasonal swing and partly as reflection of the heavy engagements that some consumers had made in September, when certain prices were being advanced. That swelled production in October, the official report showing steel ingot output at 91 per cent of capacity, close to the record of last April. November opened with a rate of about 90 per cent, closing with a rate of about 80 per cent, but with no prospect of further decline other than the usual holiday slackening.

The year's steel ingot production promises to run close to 50,000,000 long tons, representing a 13 to 14 per cent gain over 1927 and a 5 to 6 per cent gain over 1926, hitherto the record year.

*Pig Iron.*—In all districts prices have been rising since late in August, but the turnover at full asking prices is not large, some consumers having doubts as to a continuation of the upward tendency. The Valley market is quotable at $18@$18.50 for Bessemer and $17.50@$18 for basic and foundry.

*Connellsville Coke.*—The spot furnace coke market has lost its October gain, closing November at its old price of $2.75. The Frick company has put out some ovens, although only recently it was increasing production.

## Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c. London, 98 per cent, quoted at £95 per long ton, less 2 per cent, for domestic consumption.

ANTIMONY—Per lb., duty paid: Chinese brands, for all positions, 9⅞c. Cookson's "C" grade, spot, 15⅜c. Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c. Nominal.

BISMUTH—Per lb., in ton lots, $1.70. Smaller lots $1.85 and up. London 7s. 6d.

CADMIUM—Per lb., 80@90c. Active. London, 4s. 8d.@4s. 10d. for Australian metal, early delivery.

COBALT — Per lb., f.o.b. Canadian works: Shot, 96@98 per cent, $2.50@$3, quiet. Black oxide, 70 per cent, $2.10. London, 10s. for metal in small lots, 8s. for black oxide; 8s. 10d. for gray.

[1]GERMANIUM OXIDE — Per gram in 300- to 500-gram lots, $5.

IRIDIUM—Per oz., $280@$290 for 98 @99 per cent sponge and powder. London, £57@£60.

[1]LITHIUM—Per oz., 98@99 per cent grade in 1- to 5-lb. lots, $5.

MAGNESIUM — Per lb., in ton lots, single orders for spot metal: 8-lb. ingots (3x3x15 or 16 in.), 85c.@$1.05, depending on quantity; 2½- or 3-lb. sticks (1⅛ in.), $0.90@$1.10, depending on quantity; 10-oz. sticks (1x12 in.), 85@90c. Discounts up to 20 per cent on larger orders or contracts. Market firm. London 3s. 3d.@3s. 9d. for 99 per cent ingots or sticks.

[1]MOLYBDENUM—Per lb. in 1- to 3-lb. lots, 99 per cent, $18. (Usually sold as calcium molybdate or ferromolybdenum, which see).

NICKEL—Per lb., ingot, 35c.; shot, 36c.; electrolytic (99.90 per cent), 37c., for single lots of spot metal. The leading seller announces that most of the company's production at Port Colborne, Ont., in 1929, will be in the form of electrolytic nickel cathodes (99.95 per cent) and that this grade will be furnished, in 1929, at the prices quoted above for ingots and shot. Contracts for next year are now being arranged at the customary concessions from open market prices. London, per long ton, £170@£175 according to quantity.

OSMIUM—Per oz., $55@$65; London, £12@£14.

PALLADIUM — Per oz., $42@$46. London, £10 10s. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $76. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $71@$72 bid, $72@$73 asked. Market quiet.

London, per oz., £15@£15 10s. for refined; crude and scrap, nominal at £13 10s.@£14. Market depressed.

QUICKSILVER—Per 76-lb. flask, $122@$123. Small lots command the usual premium. Market very quiet. San Francisco wires $124.75, for retail and small wholesale lots. London quiet, with offers of spot at £22 5s.@£22 10s.

RADIUM — Per mg. radium content, $70.

RHODIUM—Per oz., $40@$55. Nominal. London, £11@£12.

RUTHENIUM — Per oz., $45@$55. Nominal. London, £9@£10.

[1]SELENIUM — Per lb. in tons lots: Black, powdered, amorphous, 99.5 per cent pure, $2.25. London, 7s. 8d.@7s. 9d.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure, 20c.; tantalum powder, 11c.

TELLURIUM—Per oz., 15@18c.

[1]Price furnished by Foote Mineral Co., Philadelphia.

THALLIUM METAL — $12.50@$15 per lb.

TUNGSTEN POWDER—Containing 97 to 98 per cent tungsten, per lb., $1.10@$1.20, depending on quantity. Nominal.

[1]ZIRCONIUM METAL—Per oz., 98 per cent grade, $1.56 in 5- to 10-lb. lots.

## Metallic Ores

ANTIMONY ORE—Bolivian ore, 60 per cent metallic antimony, $1.40 per short ton unit, c.i.f. New York.

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, Indian and Rhodesian ores, $22 for 47 per cent $Cr_2O_3$ ore to $23 for 50@51 per cent ore. New Caledonian ore, high-grade, $25.

IRON ORE—Per long ton, lower Lake ports. Lake Superior ores.

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.25.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range, bessemer, 51½ per cent, $4.55.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 56 to 63 per cent, 8c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

North African, low-phosphorus, 10@11c.

Spanish and North African basic, 50@60 per cent, 8½c.@9c.

Swedish foundry or basic, 66@68 per cent, 9@9½c. Nominal.

Newfoundland foundry, 55 per cent, 8½c.

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports. Exclusive of duty. Brazilian and Indian ores, minimum 47 per cent Mn, 35@36c. Caucasian (washed), 53@55 per cent, 38@40c. Market firm.

Per ton in carload lots:

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent $MnO_2$. Brazilian and Cuban, $70@$80. Caucasian, minimum 85 per cent, $70. Montana, 70 to 75 per cent, $70@$80. Domestic, 70 to 72 per cent, $40@$50.

TANTALUM ORE—Per unit of $Ta_2O_5$, basis 60 per cent ore, $13.

TITANIUM ORE—Ilmenite, per gross ton, 52 to 60 per cent $TiO_2$, f.o.b. Atlantic seaboard, $9.50@$11, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, per lb., 93 per cent concentrate, 10c. for 30-ton lots.

TUNGSTEN ORE—Per short-ton unit of $WO_3$, N. Y.: Wolframite, $11.30. Western scheelite, $11.90. Shortage of stocks but little consumer demand.

VANADIUM ORE—Per lb. $V_2O_5$ contained, 28c.

ZIRCON ORE—Per net ton containing 55 per cent $ZrO_2$, f.o.b. Atlantic seaboard, $40@$45 in 30-ton lots.

## Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]AMBLYGONITE—Per ton, f.o.b. mines: 8@9 per cent lithium oxide, $50@$60.

ASBESTOS—Per ton: f.o.b. Quebec mines, tax and bags included, prices quoted by leading interest:

Crude No. 1, $600@$650; crude No. 2, $375@$400; spinning fibers, $190@$225; magnesia and compressed sheet fibers, $160@$175; shingle stock, $55@$115, various grades; paper stock, $45@$50; cement stock, $25; short fibers, $10@$20; floats, $15. Market firm, with better demand for shorter grades.

Per ton c.i.f. New York: Rhodesian crude No. 1, $450; No. 2, $350.

BARYTES—Per ton: f.o.b. mines, bags extra:

*Georgia:* Barytes ore, crude (per long ton), $6.50@$7. Washed and water floated to 97 per cent through 300 mesh, $19. Demand continues steady at about 75 per cent of normal.

*Missouri:* Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $6.50, f.o.b. mines. Market steady, fair demand.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent $Al_2O_3$, 1.5 to 2.5 per cent $Fe_2O_3$, $7.50@$8, f.o.b. *Georgia* mines. Other grades, 56 to 59 per cent $Al_2O_3$, 5 to 8 per cent $SiO_2$, $7.50@$8.50 f.o.b. *Georgia-Alabama* mines. Pulverized and dried, $14; calcined, 78 to 84 per cent $Al_2O_3$, $18@$20.

Per metric ton, foreign, c.i.f. Atlantic port: Dalmatian, 50 to 55 per cent $Al_2O_3$, 1 to 3 per cent $SiO_2$, $4.80@$6.50; Istrian, 54 to 5 per cent $Al_2O_3$, 3 to 5 per cent $SiO_2$, $5.50@$7; French, 56 to 59 per cent $Al_2O_3$, 2 to 5 per cent $SiO_2$, $6@$8.

BORAX—Per lb.: Carload lots, in bags, crystals, 2¾c.; granulated or powdered, 2½c.; f.o.b. consumers' shipping point.

[1]CELESTITE—Per ton in carload lots: 90 per cent $SrSO_4$, finely powdered, $27.

CHALK—Per ton: Crude in bulk, c.i.f. *New York,* $4.75@$5.

CHINA CLAY (KAOLIN)—Per ton: F.o.b. *Virginia* mines, crude lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $8@$15; ground, $7@$10.

*Florida,* pressed pottery, bulk, $13; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour, No. 1, $20; No. 2, $17. Market fair.

Best grade, domestic, $16@$18, f.o.b. *Delaware* plants in carload lots.

Imported English, f.o.b. American ports: Lump, $13@$21; powdered, $40@$45.

DIATOMITE — Per short ton, f.o.b. producing plant:

Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder, $25; natural aggregate, ¼ in., $18@$20; air-floated powder, $45; 80 to 85 per cent silica, 98 per cent through 200 mesh, $20 in carload lots. Market fair.

EMERY — F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 5½c.; domestic, 3½c. Market good.

FELDSPAR—F.o.b. mine or grinding plant:

*North Carolina,* per long ton, No. 1 pottery grade, crude, $6.50@$8.50; glass grades, $5.50@$6. Market good for No. 1 grade, fair for No. 2.

No. 1, pottery, 140 mesh, $16; 200 mesh, $18. No. 2, enamel, 20 mesh, $10.25; 90 mesh, $12; 140 mesh, $13.75; 200 mesh, $15.50. No. 3, 20 mesh, $9. Market good.

*New Hampshire,* per ton: Pottery grade, $8. Best quality lump, $9.

*New York,* per ton: f.o.b. cars, No. 1 crude, $9. Market fair.

*Maine,* per ton: Best pottery grade, ground, $19. Market fair.

FLUORSPAR—Per ton: F.o.b. *Kentucky* and *Illinois* mines:

Gravel, not less than 85 per cent $CaF_2$, and not over 5 per cent $SiO_2$, $18. Foundry lump, 85-5, $20, effective Dec. 1. Ground, 95 to 98 per cent $CaF_2$, and not over 2½ per cent $SiO_2$, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots. Usual seasonal inquiries, with most business limited to filling requirements for immediate needs only.

*New Mexico:* 85-5 gravel. $16.50; 85-5 lump, $16.50; 94-3 lump, $21; 97-3 sacked, $33.

Foreign spar, duty paid, $19.40, tidewater.

FULLER'S EARTH — Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 16 to 60 mesh, $17; 60 to 90 mesh, $14; 100 mesh up, $7. Market good.

Powdered, import duty paid, $24@$25 per ton.

GARNET — Per ton; domestic, f.o.b. mines, $85. Buyers are being urged to order well advance of requirements for winter months because of the difficulties in expanding operation at domestic properties during the inclement weather.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE—Per ton, carload lots, f.o.b. mines *Colorado:*

Selected grade, $33; seconds (mine run), $25.50. Normal market.

GRAPHITE—Per lb., f.o.b. *New York:*

Ceylon lump, 7½@8½c.; chip, 6½@7½c.; dust, 2½@5c; Madagascar flake, 7@7½c.

No. 1 flake, 8c. and up. No. 2 flake, 7c. and up. Foundry facings, 3c. and up. Graphite facings, 4c. and up. Amorphous and crystalline, fine ground, 3c. and up. Market very competitive and price cutting common. Import prices considered favorable to American buyers.

Crude amorphous graphite, $15@$35 per ton, according to grade. Slightly improved demand.

GREENSAND—Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade in carload lots, $20. Prospects for greater use of greensand in chemical industries reported as favorable.

[1]Price furnished by Foote Mineral Co., Philadelphia.

GYPSUM—Per ton, f.o.b. mill, depending upon location: Crushed, $1.70@$6; ground, $4@$9; agricultural, $4@$9; calcined, $4@$13.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red, 3@4½c.; domestic earth, 2@4½c.

KAOLIN—See China Clay.

[1]LEPIDOLITE—Per ton: $20@$30 for ordinary grades. Nominal.

LIMESTONE—Per ton: f.o.b. shipping points, depending on location, either lump or crushed, 25c.@$3.

Agricultural, 40c. up to $5 for crushed or pulverized. Prices depend upon source, purity, and fineness.

MAGNESITE — Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mush, $43; Grade B, $40; dead burned, $29; crude, $11; high-purity periclase, f.o.b. Eastern seaboard, calcined, $40. *Washington:* Dead-burned magnesite, $22@$24 per net ton, Chewelah, Wash.

MICA—Per ton, f.o.b. plant:

*New Hampshire:* Mine run, $320; clean shop scrap, $25; roofing, $24. White dry ground, 20 mesh, $25; 40 mesh, $38; 60 mesh, white, $60; off-color, $34; 100 mesh, $70; 200 mesh, $80. Granite-mica facings for cement block and stucco use, $8@$12, depending on size between ¼ in. and 10 mesh. Improved demand and firmer prices. particularly in washers, disks and square cuts.

*North Carolina:* White, ground, 20 mesh, $35; 70 mesh, $100.

Madagascar, amber, per lb., f.o.b. *New York,* duty paid: No. A1, $2.50; No. 1, $2; No. 2, $1.65; No. 3, $1.15; No. 4, 60c.; No. 5, 45c. Market slow.

[1]MONAZITE—Per ton: (Minimum 6 per cent $ThO_2$), $130.

OCHER — F.o.b. *Georgia* mines, per ton: $19@$20 in sacks; $21@$22 in barrels; washed and water floated, $18; second grade, 99 per cent through 225 mesh, $18. Market good.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

*Florida,* pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10. Prices firm.

*Florida,* pebble, domestic: 76@77 per cent, $6.50; 74@75 per cent, $5.50; 72 per cent, $4.50; 70 per cent, $4.

*Tennessee,* ground, 90 per cent through 200 mesh, 33 per cent $P_2O_5$, $11.20 per short ton. Brown lump for acid manufacture, per gross ton, $6 on 75 per cent basis; $5.25 on 72 per cent basis. Non-acidulated, fine ground, 65 per cent, $8 (per short ton).

POTASH—The ruling contract prices are as follows:

| | Bags | Bulk |
|---|---|---|
| Muriate of potash 80 @ 85 per cent, basis 80 per cent | 36.40 | 34.80 |
| Sulphate of potash 90 @ 95 per cent, basis 90 per cent | 47.30 | 45.70 |
| Sulphate of potash-magnesia 48 @ 53 per cent, basis 48 per cent | 27.25 | 25.65 |
| Manure salt 30 per cent | 21.75 | 18.75 |
| Manure salt 20 per cent | 15.40 | 12.40 |
| Kainit 14 @ 16 per cent | 12.50 | 9.50 |
| Kainit, 12.4 per cent | 12.00 | 9.00 |

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

PUMICE STONE—Per lb.: In barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur: C.i.f. United States ports; guaranteed 48 per cent sulphur: Spanish, 13c.; Tharsis, furnace size, 2½ in. diameter, 14c. Cinder from ore to remain property of buyers.

[1]QUARTZ ROCK CRYSTALS—Per lb. in ton lots: Colorless, clear but flawed, pieces ¼ to ½ lb. in weight, 20c. For optical purposes, four times above price; larger crystals still higher.

SILICA—Per ton: Water ground and floated, in bags, f.o.b. Illinois: 400 mesh, $31; 350 mesh, $26; 250 mesh, $18. Market fair. Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$3.50; blast sand, $1.35@$3.50.

[1]SPODUMENE — Per ton: $20@$30, depending upon lithium content. Nominal.

SULPHUR—Per long ton for domestic market, $18 f.o.b. Texas mines; $22 for export, Atlantic ports. Prices in reality are on a c.i.f. basis, but the average price reduced to an f.a.s. figure is about as given. Open prices $1 to $3 higher than above.

TALC—Per ton, carload lots, f.o.b. works, containers included:

*Vermont:* 99 per cent through 200 mesh, extra white, $9.50@$10; 97½ to 98½ per cent through 200 mesh, medium white, $9@$9.50; packed in 50-lb. paper bags; prices $1 per ton less in burlap sacks.

*New York:* Double air-floated, short fiber, 200 mesh, $13.75; 325 mesh, $14.75. Market fair.

*Georgia:* Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9.

*New Jersey:* Soapstone, ground, $10@$12.

TRIPOLI—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh; rose and cream colored, $14. Double ground through 110 mesh; rose and cream, $17. Air-floated through 200 mesh, rose and cream, $25; mill run, $15. Usual good winter business.

## Metallic Compounds

ANTIMONY OXIDE—White, Chinese, 99 per cent $Sb_2O_3$, 15½c. per lb.

ARSENIOUS OXIDE (White arsenic)—Per lb., 4c.; delivered near by. Market firm. London, per long ton, £16½@£16¾ quoted for Cornish white; Mexican high grade, £17 5s., c.i.f. Liverpool.

CALCIUM MOLYBDATE OR MOLYTE — Per lb. of contained Mo, 95c., delivered.

COPPER SULPHATE (Blue Vitriol)—Per lb. in car lots, 5.50c., for either large or small crystals.

SODIUM NITRATE—Per 100 lb.; crude, in bags ex vessel, Atlantic ports, $2.17½ for spot; future delivery, $2.17½@$2.20.

SODIUM SULPHATE (Salt Cake)—Per ton, bulk, f.o.b. works, $12.50@$18; in barrels, $21@$23.

[1]Price furnished by Foote Mineral Co., Philadelphia.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6⅝c.; French red seal, in bags, 9⅛c.

## Alloys

[1]FERROCERIUM—Per lb., $9 in 15 to 75 lb. lots.

FERROCHROME—Per lb. of contained chromium, 60@70 per cent chromium, 4 to 6 per cent carbon, 11c. Spot shipments ½c. higher. Freight allowed in carload lots east of Mississippi River and north of Baltimore.

FERROMANGANESE — Per gross ton furnace: Domestic and foreign, 78@82 per cent, $105. Spiegeleisen, 19@21 per cent, $34 on carload business, f.o.b. furnace.

FERROMOLYBDENUM—Per lb. of Mo., f.o.b. shipping point, 50@60 per cent Mo, $1.20. Firm.

FERROPHOSPHORUS—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee.*

FERROSILICON—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River and north of Baltimore: 50 per cent, $83.50; 75 per cent, $130; 15@17 per cent, $45, f.o.b. Suspension Bridge, N. Y. Quotations for spot shipments slightly higher. Market active.

FERROCARBONTITANIUM — Per ton: For 15 to 18 per cent material, $200, f.o.b. Niagara Falls, N. Y.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, 98c.@$1, f.o.b. works.

FERROVANADIUM—Per lb. of V contained, f.o.b. works, freight allowed, $3.15@$3.65, depending on grade and quantity.

MONEL METAL—Per lb. base price for shot, 28c., f.o.b. Huntington, W. Va.

NICKEL SILVER—31c. per lb. for 18 per cent nickel Grade A sheets.

YELLOW (MUNTZ) METAL—Dimension sheets, 21½c. per lb.; rods, 18½c. per lb.

## Rolled Metals

COPPER — Sheets, hot-rolled, 25c.; wire, 17⅞c. per lb., f.o.b. mill.

LEAD SHEETS—Full rolled, 10c. per lb.; clipped, 10¼c.

ZINC SHEETS — Per lb., 9¾c., f.o.b. works.

## Refractories

CHROME BRICK—Per net ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M.: First quality, $43@$46, *Ohio, Kentucky, Central Pennsylvania;* second quality, $35@$38.

MAGNESITE—Brick, per net ton, f.o.b. works: 9-in. straights, $65. Cement, $40, seaboard.

SILICA BRICK—Per M., *Pennsylvania* and *Ohio,* $43; *Alabama,* $51; *Illinois,* $52.

[1]ZIRKITE—Per lb.: Powdered, 80 per cent $ZrO_2$, 3½c. Brick, straights, 80c.@$1 each.

# Metal Statistics

## Monthly Average Prices of Metals

### Silver

| | New York | | London Spot | | Sterling Exchange | |
|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 |
| January | 55.795 | 57.135 | 25.863 | 26.313 | 484.775 | 487.098 |
| February | 57.898 | 57.016 | 26.854 | 26 205 | 484.551 | 487 008 |
| March | 55.306 | 57 245 | 25.655 | 26.329 | 484.887 | 487.558 |
| April | 56.399 | 57.395 | 26.136 | 26.409 | 485.178 | 487.785 |
| May | 56.280 | 60.298 | 26.072 | 27.654 | 485.288 | 487.685 |
| June | 56.769 | 60.019 | 26.203 | 27.459 | 485.183 | 487.565 |
| July | 56.360 | 59.215 | 25.983 | 27.262 | 485.145 | 485.923 |
| August | 54.718 | 58.880 | 25.224 | 27.096 | 485.546 | 484.979 |
| September | 55.445 | 57.536 | 25.565 | 26.440 | 485.878 | 484 654 |
| October | 56.035 | 58.087 | 25.776 | 26.727 | 486.533 | 484.584 |
| November | 57.474 | 57.953 | 26.526 | 26.704 | 486.956 | 484.492 |
| December | 57.957 | ..... | 26.701 | ..... | 487.714 | ..... |
| Year | 56.370 | ..... | 26.047 | ..... | 485.636 | ..... |

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

### Copper

| | New York | | London Spot | | | |
|---|---|---|---|---|---|---|
| | Electrolytic | | Standard | | Electrolytic | |
| | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 |
| January | 12.990 | 13.854 | 55.414 | 61.912 | 62.375 | 66.575 |
| February | 12.682 | 13 823 | 54.438 | 61.670 | 61.119 | 66.381 |
| March | 13.079 | 13 845 | 55.935 | 61.148 | 62.641 | 66.443 |
| April | 12.808 | 13.986 | 55.056 | 61.678 | 61.526 | 66.500 |
| May | 12.621 | 14.203 | 54.563 | 62.554 | 60.881 | 67.216 |
| June | 12.370 | 14.527 | 54.030 | 63.664 | 59.881 | 68 738 |
| July | 12.532 | 14.527 | 54.551 | 62.881 | 60.089 | 68.670 |
| August | 12.971 | 14.526 | 55.364 | 62.472 | 62.227 | 68.750 |
| September | 12.940 | 14 724 | 54.455 | 63 522 | 61.830 | 69 800 |
| October | 12.958 | 15 202 | 55.119 | 65.524 | 62.256 | 71.935 |
| November | 13.319 | 15.778 | 58.830 | 68.080 | 63.761 | 74.750 |
| December | 13.774 | ..... | 60.078 | ..... | 66.181 | ..... |
| Year | 12.920 | ..... | 55.653 | ..... | 62.064 | ..... |

New York quotations, cents per pound. London, pounds sterling per long ton.

### Lead

| | New York | | St. Louis | | London | | | |
|---|---|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 | 1928 | 1927 Spot | 1927 3 Mos. | 1928 Spot | 1928 3 Mos. |
| January | 7.577 | 6.500 | 7.392 | 6.280 | 27.485 | 27.786 | 21.773 | 22.213 |
| February | 7.420 | 6.329 | 7.286 | 6.069 | 27.344 | 27.781 | 20.283 | 20 747 |
| March | 7.577 | 6.000 | 7.328 | 5.805 | 27.845 | 28.302 | 19.938 | 20.352 |
| April | 7.126 | 6.100 | 6.807 | 5.991 | 26.546 | 27.053 | 20.306 | 20.563 |
| May | 6.616 | 6.123 | 6.269 | 6.012 | 25.054 | 25.526 | 20.483 | 20.813 |
| June | 6.414 | 6.300 | 6.150 | 6.152 | 24.438 | 24.750 | 20.985 | 21.211 |
| July | 6.344 | 6.220 | 6.120 | 6.038 | 23.491 | 23.932 | 20.602 | 20.957 |
| August | 6.681 | 6.248 | 6.367 | 6.056 | 23.119 | 23.540 | 21.634 | 21.628 |
| September | 6.297 | 6 450 | 6.044 | 6.286 | 21.446 | 21.994 | 22.050 | 21.769 |
| October | 6.250 | 6.500 | 6.013 | 6.318 | 20.479 | 20.946 | 22.082 | 21.796 |
| November | 6.259 | 6.389 | 6.035 | 6.222 | 20.889 | 21.318 | 21.239 | 21.469 |
| December | 6.504 | ..... | 6.319 | ..... | 22.163 | 22.441 | ..... | ..... |
| Year | 6.755 | ..... | 6.511 | ..... | 24.192 | 24.614 | ..... | ..... |

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

### Tin

| | New York | | | | London | |
|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 |
| | 99% | | Straits | | Spot | |
| January | 64.785 | 55.180 | 66.415 | 55.650 | 297.804 | 253.222 |
| February | 66.528 | 51.793 | 69.142 | 52.440 | 306.125 | 233.833 |
| March | 67.833 | 51.630 | 69.199 | 52.220 | 313.315 | 232.722 |
| April | 66.069 | ..... | 67.933 | 52.270 | 302.572 | 234.204 |
| May | 63.935 | ..... | 67.510 | 51.582 | 294.938 | 230.886 |
| June | 64.226 | ..... | 67.466 | 47.938 | 296.006 | 217.280 |
| July | 62.625 | ..... | 64.110 | 47.040 | 288.690 | 212.44 9 |
| August | 63.523 | ..... | 64.431 | 48.012 | 293.193 | 212.847 |
| September | 60.735 | ..... | 61.490 | 48 073 | 280.432 | 215.663 |
| October | 57.560 | ..... | 58.450 | 48.966 | 264.631 | 222.005 |
| November | 57.089 | ..... | 57.641 | 50.750 | 262.591 | 232.875 |
| December | 58.053 | ..... | 58.452 | ..... | 267.138 | ..... |
| Year | 62.747 | ..... | 64.353 | ..... | 288.953 | ..... |

New York quotations, cents per pound. Quotations on 99 per cent tin discontinued on April 1, because of absence of business. London, pounds sterling per long ton.

### Zinc

| | St. Louis | | London | | | |
|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 Spot | 1927 3 Mos. | 1928 Spot | 1928 3 Mos. |
| January | 6.661 | 5.643 | 30.979 | 30.938 | 26.125 | 26.051 |
| February | 6.673 | 5.551 | 29.931 | 30.109 | 25.518 | 25.506 |
| March | 6.692 | 5 624 | 30.649 | 30.889 | 25.082 | 24.960 |
| April | 6.338 | 5.759 | 29.579 | 29.901 | 25.493 | 25.316 |
| May | 6.075 | 6.026 | 29.034 | 29.131 | 26.102 | 25.756 |
| June | 6.213 | 6.158 | 28.598 | 28.613 | 25.664 | 25.429 |
| July | 6.229 | 6.201 | 28.280 | 28.021 | 24 946 | 24.972 |
| August | 6.342 | 6.249 | 28.210 | 28.068 | 24.540 | 24.713 |
| September | 6.212 | 6 250 | 27.347 | 27.327 | 24 497 | 24 625 |
| October | 5.996 | 6 250 | 26.899 | 26.634 | 24 030 | 24 296 |
| November | 5.745 | 6 263 | 26.281 | 26.006 | 24.801 | 24.827 |
| December | 5.722 | ..... | 26.363 | 26.109 | ..... | ..... |
| Year | 6.242 | ..... | 28.513 | 28.479 | ..... | ..... |

St. Louis quotations, cents per pound. London pounds sterling per long ton

## Antimony, Quicksilver and Platinum

| | Antimony (a) | | Quicksilver (b) | | Platinum (c) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Refined | | Crude | |
| | New York | | New York | | New York | | | |
| | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 |
| Jan | 13.910 | 10.863 | 101.200 | 123.620 | 109.520 | 79.280 | 99.820 | 69.280 |
| Feb | 14.509 | 10 842 | 101.727 | 121.370 | 107.545 | 84 783 | 99.295 | 74.783 |
| March | 12.801 | 10.083 | 110.259 | 122.557 | 108.000 | 80.000 | 100.426 | 70.000 |
| April | 14.166 | 9.865 | 123.250 | 123.740 | 101.885 | 80 000 | 91.865 | 70.000 |
| May | 12.975 | 11.019 | 123.900 | 123.173 | 84.680 | 78.000 | 75.000 | 68.000 |
| June | 12.447 | 9.750 | 118.096 | 122.423 | 72.000 | 78 000 | 62.500 | 68.000 |
| July | 11.880 | 9.540 | 119.880 | 121.260 | 72.000 | 78.000 | 61.520 | 68 000 |
| Aug | 11.826 | 10.181 | 119.111 | 124.500 | 72.000 | 78.000 | 62.000 | 68.000 |
| Sept | 11.073 | 10 813 | 119.640 | 128.000 | 72.000 | 78.000 | 62.000 | 68 000 |
| Oct | 11.165 | 10.841 | 126.200 | 125.923 | 72.000 | 78.000 | 62.000 | 68.000 |
| Nov | 10.763 | 10.109 | 127.708 | 123.000 | 72.000 | 76.417 | 62.000 | 66.417 |
| Dec | 11.195 | ..... | 126.933 | ..... | 72.000 | ..... | 62.000 | ..... |
| Year | 12.393 | ..... | 118.159 | ..... | 84.636 | ..... | 75.036 | ..... |

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. Prior to June, 1927, the unit had been the 75-lb. flask. (c) Platinum in dollars per ounce.

## Pig Iron, Valley[1], and Aluminum

| | Bessemer | | Basic | | No. 2 Foundry | | Aluminum | |
|---|---|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 |
| Jan | 19.50 | 17 50 | 18.16 | 17.00 | 18.50 | 17 25 | 26.270 | 24.300 |
| Feb | 19.02 | 17.50 | 18.00 | 17.00 | 18.50 | 17.25 | 26.000 | 24.300 |
| March | 19.37 | 17.50 | 18.28 | 17.00 | 18.50 | 17.25 | 26.000 | 24.300 |
| April | 19.50 | 17.50 | 19.00 | 17.00 | 18.50 | 17.24 | 26.000 | 24.300 |
| May | 19.24 | 17.37 | 18.24 | 16.38 | 18.50 | 16.79 | 26.000 | 24.300 |
| June | 18.96 | 17.00 | 17.96 | 15.56 | 18.35 | 16.79 | 26.000 | 24.300 |
| July | 18.50 | 17.00 | 17.50 | 15.75 | 18.00 | 16.69 | 26.000 | 24.300 |
| Aug | 18.50 | 17.00 | 17.32 | 15.75 | 17.65 | 16.50 | 26.000 | 24.300 |
| Sept | 18.00 | 17.00 | 17.11 | 15.75 | 17.50 | 16 50 | 26.000 | 24.300 |
| Oct | 18.00 | 17.24 | 17.00 | 16.66 | 17.50 | 16.74 | 25.600 | 24.300 |
| Nov | 18.00 | 17.82 | 17.00 | 17.32 | 17.47 | 17.32 | 25.000 | 24.300 |
| Dec | 17.69 | ..... | 17.00 | ..... | 17.25 | ..... | 24.785 | ..... |
| Year | 18.69 | ..... | 17.71 | ..... | 18.02 | ..... | 25.808 | ..... |

Iron in dollars per long ton. Aluminum in cents per pound, 99 per cent grade.

[1]F.o.b. Mahoning and Shenango valley furnaces; freight to Pittsburgh, $1.76.

## Monthly Crude Copper Output in Short Tons

### Domestic

| | 1928 | | | | | |
|---|---|---|---|---|---|---|
| | May | June | July | Aug. | Sept. | Oct. |
| Alaska shipments | 1,767 | 2,351 | 999 | 2,219 | 661 | 3,036 |
| Calumet & Arizona | 2,726 | 1,991 | 1,593 | 2,205 | 2,337 | 2,201 |
| Magma | 1,451 | 1,593 | 1,584 | 1,427 | 1,678 | 1,877 |
| Miami | 2,185 | 2,055 | 1,756 | 1,924 | 1,770 | 2,133 |
| New Cornelia | 2,924 | 3,050 | 2,989 | 3,673 | 3,230 | 3,190 |
| Nevada Con | ..... | †31,854 | ..... | ..... | †35,476 | ..... |
| Old Dominion* | 1,010 | 882 | 819 | 968 | 818 | 840 |
| Phelps Dodge†† | 8,083 | 8,887 | 8,193 | 9,330 | 7,892 | 10,054 |
| United Verde Extension | 1,724 | 1,670 | 1,793 | 2,027 | 1,757 | 2,065 |
| Utah Copper | ..... | †30,296 | ..... | ..... | †35,858 | ..... |
| Tennessee Copper | 582 | 527 | 541 | 594 | 594 | 621 |

### Foreign

| | | | | | | |
|---|---|---|---|---|---|---|
| Andes Copper | 2,816 | 4,114 | 4,315 | 4,016 | 4,925 | ..... |
| Braden | 9,544 | 8,129 | 9,079 | 8,234 | 8,193 | ..... |
| Boleo, Mexico | 953 | 882 | ..... | ..... | †3,053 | ..... |
| Bwana M'Kubwa | 556 | 542 | 629 | 499 | 556 | 530 |
| Chile | 8,787 | 9,785 | 9,969 | 9,365 | 11,336 | ..... |
| Furukawa, Japan | 1,286 | 1,350 | 1,274 | 1,536 | 1,661 | ..... |
| Granby Cons., Canada | 2,505 | 2,345 | 2,492 | 2,517 | 2,445 | 2,447 |
| Howe Sound | ..... | †5,851 | ..... | ..... | †5,039 | ..... |
| Mount Lyell, Australia | ..... | †1,594 | ..... | ..... | †2,274 | ..... |
| Sumitomo, Japan | 1,475 | 1,347 | 1,611 | 1,643 | ..... | ..... |
| Union Miniere, Africa | 10,689 | 10,120 | 10,820 | 10,775 | 10,248 | 10,120 |

†Three months. *Includes Arizona Commercial.
††Moctezuma is included.

## Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

| | 1926 | | 1927 | | 1928 | |
|---|---|---|---|---|---|---|
| | Monthly Production | Daily Rate | Monthly Production | Daily Rate | Monthly Production | Daily Rate |
| January | 71,026 | 2,291 | 76,198 | 2,458 | 68,469 | 2,209 |
| February | 68,131 | 2,433 | 69,202 | 2,472 | 67,423 | 2,352 |
| March | 75,728 | 2,443 | 69,314 | 2,236 | 70,327 | 2,269 |
| April | 73,454 | 2,448 | 71,122 | 2,371 | 69,721 | 2,324 |
| May | 73,542 | 2,372 | 71,613 | 2,310 | 73,729 | 2,378 |
| June | 71,317 | 2,377 | 69,539 | 2,318 | 73,224 | 2,441 |
| July | 72,228 | 2,330 | 65,545 | 2,114 | 73,426 | 2,369 |
| August | 72,014 | 2,323 | 67,248 | 2,169 | 76,952 | 2,482 |
| September | 72,672 | 2,421 | 65,936 | 2,198 | 77,085 | 2,570 |
| October | 75,099 | 2,423 | 68,595 | 2,225 | 85,801 | 2,768 |
| November | 74,947 | 2,498 | 68,080 | 2,269 | ..... | ..... |
| December | 72,205 | 2,329 | 67,377 | 2,173 | ..... | ..... |
| Total | 872,509 | .... | 829,878 | .... | 736,157 | .... |
| Monthly average | 72,709 | .... | 69,165 | .... | 73,616 | ..... |
| Average of daily rate | ..... | 2,390 | ..... | 2,274 | ..... | 2,414 |

# Mining Stocks—Week Ended December 1, 1928

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **COPPER** | | | | | | |
| Anaconda | New York | 116⅛ | 111 | 111⅛ | Oc.13, No. 19 Q | 1.00 |
| Andes Copper | New York | 56 | 49 | 49⅞ | ..... | ..... |
| Ariz. Com'l | Boston | 5 | 4⅜ | 4 1/16 | Jl. 16, Jl. 31 SA | 0.25 |
| Cal. & Ariz. | New York | 127 | 120 | 121 | De. 1, De. 17 QX | 2.50 |
| Calumet & Hecla | Boston | 46⅛ | 45½ | 45½ | No 30, De.15,Q | 1.00 |
| Cerro de Pasco | New York | 119 | 113½ | 116½ | Oc.11, No. 1 Q | 1.25 |
| Chile Copper | New York | 74⅞ | 68 | 71⅛ | De.5 , De.29 Q | 0.75 |
| Con. Coppermines | N. Y. Curb | 15⅛ | 14⅛ | 14⅞ | ..... | ..... |
| Copper Range | Boston | 29⅛ | 25 | 28⅛ | Mr. 24, Ap. 20 A | 1.00 |
| Crystal Copper | Boston Curb | *25 | *17 | *24 | ..... | ..... |
| East Butte | Boston | 4⅜ | 4⅛ | 4⅛ | Dec., 1919 | 0.50 |
| Granby Consol | New York | 84⅛ | 82⅛ | 84 | Oc.11, No.1 Q | 1.00 |
| Greene Cananea | New York | 169⅞ | 158 | 158 | De 1 , Ja.7 Q | 1.50 |
| Howe Sound | New York | 73⅜ | 69½ | 71⅛ | Se.29, Oc.15, Q | 1.00 |
| Inspiration Consol | New York | 48⅜ | 45⅛ | 45⅛ | De. 20, Ja. 7 Q | 0.75 |
| Isle Royale | Boston | 28⅛ | 26 | 28 | Au.31, Se.15SA | X0.75 |
| Kennecott | New York | 150⅜ | 142⅛ | 143⅛ | No.30, Ja 2 Q | 2.00 |
| Magma Copper | New York | 73⅛ | 68 | 70⅜ | Oc.1, Oc.15 Q | 0.75 |
| Mason Valley | N. Y. Curb | 2 | 1⅛ | 2 | ..... | ..... |
| Miami Copper | New York | 31⅛ | 29⅜ | 31⅛ | No.1, No.15, Q | 0.37½ |
| Mohawk | Boston | 56⅛ | 42 | 55 | Oc. 31, De. 1 Q | 3.00 |
| Montana-Idaho | Spokane | *10 | *9½ | *9½ | ..... | ..... |
| Mother Lode Coal | New York | 3⅜ | 3⅛ | 3⅛ | Je.8, Je. 30, SA | 0.15 |
| Nevada Consol | New York | 39 | 37⅛ | 38 | Se.14, Se.29 Q | 0.37½ |
| New Cornelia | Boston | 45⅜ | 44⅛ | 44⅜ | No.2, No. 19 Q | 0.50 |
| Noranda | N. Y. Curb | 70½ | 63½ | 65⅛ | ..... | ..... |
| North Butte | Boston | 8 | 7 | 7⅛ | Oct., 1918 | 0.25 |
| Ohio Copper | N. Y. Curb | 2 | 1⅛ | 1⅛ | Sept., 1926 | 0.03 |
| Old Dominion | Boston | 20 | 18⅛ | 19 | Dec., 1918 | 1.00 |
| Phelps Dodge | N. Y. Curb | 195⅜ | 194 | 195⅜ | De.18, Ja.2 Q | 2.50 |
| Quincy | Boston | 46 | 43 | 44 | March, 1920 | 1.00 |
| St. Mary's Min. Ld. | Boston | 38⅛ | 36 | 36 | No.20, De.1 | 1.00 |
| Seneca Copper | New York | 6⅜ | 5⅜ | 6 | ..... | ..... |
| Shattuck-Denn | N. Y. Curb | 22⅞ | 19⅛ | 19⅛ | ..... | ..... |
| Tenn. C. & C. | New York | 18⅜ | 16⅛ | 18 | Au., 31 Se.15,Q | 0.25 |
| United Verde Ex | N. Y. Curb | 23⅞ | 23⅛ | 23½ | Oc.6, No.1 Q | 0.50 |
| Utah Copper | New York | 260 | 255 | 260 | Se.14, Se.29 Q | 2.00 |
| Utah Metal & T | Boston | 1⅜ | 1⅛ | 1⅛ | Dec., 1917 | 0.30 |
| Walker Mining | Salt Lake | 2.25 | 2.15 | 2.15 | ..... | ..... |
| **NICKEL-COPPER** | | | | | | |
| Internat. Nickel | New York | 227⅛ | 210½ | 214 | Se.10, Se.29 Q | 0.75 |
| Internat. Nickel pfd. | New York | 120 | 118⅛ | 118½ | Oc.1, No.1 Q | 1.50 |
| **LEAD** | | | | | | |
| Gladstone Mtn | Spokane | *5 | *4⅞ | *4⅞ | June, 1927 | 0.005 |
| National Lead | New York | 134½ | 125½ | 129 | De.14, De.31 Q | 1.25 |
| National Lead, pfd. A | New York | 140⅛ | 140⅛ | 140⅛ | No.3, De.15 Q | 1.75 |
| National Lead, pfd. B | New York | 118 | 118 | 118 | Ja. 18, Fe.1 Q | 1.50 |
| St. Joseph Lead | New York | 52⅞ | 46½ | 50⅛ | Se.8, De.20 QX | 0.75 |
| **ZINC** | | | | | | |
| Am. Z. L. & S. | New York | 48 | 43⅜ | 44½ | May, 1917 | 1.00 |
| Am. Z. L. & S. pfd. | New York | 106⅜ | 99½ | 99½ | Nov., 1920 | 1.50 |
| Butte C. & Z. | New York | 12⅛ | 9 | 10⅞ | De., 1926 | 0.50 |
| Butte & Superior | New York | 11 | 10⅜ | 10⅜ | Se.14,Se.29 Q | 0.50 |
| Callahan Zn-Ld | New York | 3½ | 3 | 3⅛ | De., 1920 | 0.50 |
| Consol.Lead&Zinc 'A' | St. Louis | 12 | 9½ | 11⅛ | Je.25, Jl.1 Q | 0.25 |
| Eagle-Picher | Cincinnati | 20 | 18½ | 20 | No.15, De.1 Q | 0.40 |
| Eagle-Picher pfd | Cincinnati | .... | .... | 100 | July 15 Q | 1.50 |
| Evans-Wallower | N. Y. Curb | 17⅛ | 12⅛ | 15⅛ | ..... | ..... |
| New Jersey Zn. | N. Y. Curb | 243 | 239 | 240 | No. 20, De. 10 X | 2.00 |
| Treadwell-Yukon | Toronto | 12½ | 12⅛ | 12⅛ | ..... | ..... |
| United Zinc | N. Y. Curb | 1⅜ | 1⅜ | 1⅜ | ..... | ..... |
| Yellow Pine | Los Angeles | *23 | *23 | *23 | Dec., 1925 QX | 0.04 |
| **GOLD** | | | | | | |
| Alaska Juneau | New York | 9⅜ | 7⅜ | 9⅜ | ..... | ..... |
| Barry-Hollinger | Toronto | *34 | *29 | *30 | ..... | ..... |
| Central Manitoba | Toronto | .... | .... | *78 | ..... | ..... |
| Coniaurium | Toronto | 1.60 | 1.60 | 1.60 | ..... | ..... |
| Creason Consol. G. | N. Y. Curb | .... | .... | *81 | Oct. 15, Q | 0.02 |
| Dome Mines | New York | 8⅞ | 8⅛ | 8⅜ | Se.29, Oc.20 Q | 0.25 |
| Gold Hill | Toronto | .... | .... | *7½ | ..... | ..... |
| Golden Cycle | Colo.Springs | †1.56 | †1.54 | .... | No. 30, De.10 Q | 0.04 |
| Hollinger Consol | Toronto | 8.65 | 8.00 | 8.25 | No 14, De. 1 M | 0.05 |
| Homestake Mining | New York | .... | .... | 80 | No.15, De.1 M | 0.50 |
| Kirkland Lake | Toronto | 1.50 | 1.30 | 1.40 | ..... | ..... |
| Lake Shore | Toronto | 19 | 18 | 18 | De.1, De.15 QX | 0.40 |
| McIntyre Porcupine | New York | 24½ | 22⅞ | 22⅞ | No.1, De.1 Q | 0.25 |
| Portland | Colo.Springs | †*10 | †*7½ | .... | Ap., 1927 | 0.02 |
| Rand Mines | New York | .... | .... | 36½ | Au.21-28 Am.Sh | 1.52 |
| Sylvanite | Toronto | 2.25 | 2.00 | 2.00 | ..... | ..... |
| Teck-Hughes | Toronto | 8.75 | 8.20 | 8.50 | Oc.17, No.1 | 0.15 |
| Tom Reed | Los Angeles | *35 | *30 | *35 | Dec., 1926 | 0.02 |
| Vipond Cons. | Toronto | *64 | *59 | *60 | April, 1927 | 0.03 |
| Wright-Hargreaves | Toronto | 2.10 | 1.95 | 2.00 | Oc.16, No.1 Q | 0 02½ |
| **GOLD AND SILVER** | | | | | | |
| Carnegie Metals | N. Y. Curb | 24½ | 22 | 23 | ..... | ..... |
| Con. Cortez | N. Y. Curb | *20 | *15 | *15 | ..... | ..... |
| Dolores Esperanza | N. Y. Curb | *97 | *81 | *97 | July, 1923 | 0.05 |
| N.Y. Hond's Rosario | N. Y. Curb | 16 | 15⅜ | 15⅜ | Oc.17, Oc.27 QX | 0.50 |
| Premier Gold | N. Y. Curb | 2⅛ | 2⅛ | 2⅛ | Se.14, Oc.4 Q | 0.06 |
| Tonopah Belmont | N. Y. Curb | *68 | *68 | *68 | Oc., 1925 | 0.05 |
| Tonopah Extension | N. Y. Curb | .... | .... | *7 | Ap., 1925 | 0.05 |
| Tonopah Mining | N. Y. Curb | 3⅛ | 3⅛ | 3⅛ | Se 29,Oc 20 SA | 0.07½ |
| West End Consol | N. Y. Curb | .... | .... | *3 | Mar., 1923 | 0.05 |
| Yukon Gold | Boston Curb | 1⅜ | 1 | 1 | June, 1918 | 0.02 |
| **SILVER** | | | | | | |
| Castle-Trethewey | Toronto | *36 | *35 | *35½ | ..... | ..... |
| Coniagas | Toronto | .... | .... | 2.85 | May, 1924 | 0.12 |
| Keeley | Toronto | *41 | *38 | *40 | Mr.1, Mr.15 SA | 0.04 |
| Mining Corp. Can. | Toronto | 4.10 | 3.60 | 4.10 | De.6, De.20 SA | 0.1¼ |
| Nipissing | N. Y. Curb | 3⅜ | 3 | 3 | Se.29, Oc.20 Q | 0.07 |

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **SILVER-LEAD** | | | | | | |
| Ahumada | New York | 4⅛ | 3½ | 3⅝ | Ap., 1927 | 0.12 |
| Bingham Mines | Boston | 46⅛ | 46 | 46 | Se.20, Oc. 5 MX | 0.50 |
| Bunker Hill & Sullivan | N. Y. Curb | .... | .... | 139½ | Oc., 31,No. 5 X | 0.75 |
| Cardiff M. & M. | Salt Lake | *36 | *35 | *36 | Feb. 5, 1927 | 0.10 |
| Chief Consol | Salt Lake | 3.85 | 3.75 | 3.75 | Ja.10, Fe.1 K | 0.10 |
| Consti'n Mng. & Mill'g | Spokane | *55 | *50 | *54 | ..... | ..... |
| Erupcion | Boston Curb | *25 | *25 | *25 | Ja , 1928 Q | 0.07½ |
| Eureka Lily | Salt Lake | 1.52½ | 1.47½ | 1.47½ | ..... | ..... |
| Federal M. & S. | New York | 220 | 193 | 220 | Je., 1927 | 10.00 |
| Federal M. & S. pfd. | New York | 101½ | 100½ | 100½ | No. 23, De. 15 Q | 1.75 |
| Golconda | Spokane | *77½ | *74 | *76½ | ..... | ..... |
| Hecla Mining | N. Y. Curb | 16⅝ | 16 | 16⅛ | No.13, De.14 Q | 0.15 |
| Highland-Surprise | Spokane | *12½ | *11¾ | *12½ | ..... | ..... |
| Iron King Mining | Salt Lake | *91 | *90 | *91 | ..... | ..... |
| Keystone Mining | Salt Lake | †*35 | †*25 | .... | Fe., 1926 | 0.07½ |
| Lucky Jim | Spokane | *25 | *24 | *25 | ..... | ..... |
| Lucky Tiger-Com | Kansas City | †6.75 | †6.50 | .... | No.4, No.20 M | 0.05 |
| Mammoth Mining | Salt Lake | *70 | *70 | *70 | De., 1926 | 0.25 |
| North Lily | Salt Lake | 8.75 | 8.75 | 8.75 | Oct., 20 I | 0.20 |
| Park Utah | New York | 13 | 12 | 12⅜ | Se., 11, Oc.1 Q | 0.20 |
| Plutus Mining | Salt Lake | †2.00 | †2.00 | .... | Ap.10, Ap.16 Q | 0.10 |
| Rico-Argentine | Salt Lake | *52 | *48 | *48 | June 15 Q | 0.03 |
| Sherman Lead | Spokane | *28½ | *25¾ | *26 | ..... | ..... |
| Silver King Coal | Salt Lake | 7.37½ | 7.37½ | 7.37½ | Se.20, Oc.1 Q | 0.25 |
| Silversmith | Spokane | *7⅛ | *7 | *7⅛ | Oct., 1926 Q | 0.02 |
| Strattons Mines | Spokane | 1.71 | 1.60 | 1.71 | ..... | ..... |
| Sunshine M. Co. | Spokane | 1.39 | 1.30 | 1.39 | June 20, K | 0.02 |
| Tamarack-Custer | Spokane | *40½ | *39 | *40 | Sept., 1924 | 0.25 |
| Tintic Standard | Salt Lake | 13.75 | 13.35 | 13.50 | Se.19, Se.29 QX | 0.30 |
| Utah-Apex | Boston | 4⅛ | 3½ | 4⅛ | Jl.14, Au.1 K | 0.25 |
| **IRON** | | | | | | |
| Bethlehem Steel | New York | 85½ | 79 | 79¾ | Jl., 1924 | 1.25 |
| Cleveland-Cliffs Iron | Cleveland | 142 | 125 | 135 | Oc.15, Oc.25. Q | 1.00 |
| Colorado F & I, pfd. | New York | 81½ | 74 | 75¾ | Au.10, Au.25 Q | 2.00 |
| Gt. North'n Iron Ore | New York | 32⅜ | 31 | 31⅛ | Ap. 9, Ap. 30 K | 0.75 |
| Inland Steel | New York | 74½ | 72⅜ | 73 | No. 15, De.1 Q | 0.62½ |
| Republic I. & S. | New York | 89⅜ | 83¾ | 84 | No. 14, De. 1 Q | 1.00 |
| Republic I. & S. pfd. | New York | 111 | 111 | 111 | De. 14, Ja. 2 Q | 1.75 |
| Sloss-Sheffield S. & I. | New York | 121 | 120½ | 121 | Se.10, Se.20 Q | 1.50 |
| Sloss-Snef. S.&I. pfd. | New York | 111 | 108 | 108 | Se. 20, Oc. 1 Q | 1.75 |
| U. S. Steel | New York | 170½ | 165 | 165 | No.30, De.29 Q | 1.75 |
| U. S. Steel, pfd. | New York | 142⅛ | 141⅜ | 141½ | No. 3, No.28 Q | 1.75 |
| Virginia I. C. & C. | New York | .... | .... | 25½ | Jan., 1924 | 1.50 |
| Virginia I.C.&C. pfd. | New York | .... | .... | 51½ | Je. 16, Jl. 2 SA | 2.50 |
| **DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN** | | | | | | |
| De Beers Consol | New York | .... | .... | 23 | Ju.16, Ju.26 K | 0.97 |
| So. Am. G. & P. | N. Y. Curb | 3⅜ | 3⅛ | 3⅜ | ..... | ..... |
| Alum. Co. of Amer. | N. Y. Curb | 160 | 155½ | 159⅜ | ..... | ..... |
| Alum. Co. of Amer. pf. | N. Y. Curb | 107⅜ | 107 | 107 | Se. 15, Oc. 1 Q | 1.75 |
| Vanadium Corp. | New York | 105⅞ | 101 | 101⅛ | De.1,De. 15 QX | 1.75 |
| Patino M. & E. | New York | 39⅜ | 35⅛ | 37⅜ | April, 1928 | 4s. |
| **ASBESTOS** | | | | | | |
| Asbestos Corp. | Montreal | 20 | 15 | 19⅛ | Jan., 1926 | 1.50 |
| Asbestos Corp. pfd. | Montreal | 69 | 60 | 66⅜ | Se.29, Oc 15 Q | 1.75 |
| **SULPHUR** | | | | | | |
| Freeport Texas | New York | 48 | 46⅛ | 46⅜ | Oc.15, No.1 QX | 1.25 |
| Texas Gulf | New York | 79⅜ | 75⅛ | 76 | De. 1, De 15 Q | 1.00 |
| **MINING, SMELTING, REFINING AND GENERAL** | | | | | | |
| Amer. Metal | New York | 63⅜ | 56⅛ | 58⅞ | No. 20, De 1 Q | 0.75 |
| Amer. Metal, pfd. 6% | New York | 116⅛ | 115 | 116⅛ | No.20, De.1 Q | 1.50 |
| Amer. Sm. & Ref. | New York | 284 | 278⅞ | 278⅜ | Oc.11, No.1 Q | 2.00 |
| Amer. Sm. & Ref. pfd. | New York | 138 | 137 | 137¼ | No.2, De. 1 Q | 1.75 |
| Consol. M. & S. | Montreal | 391 | 370 | 370 | Je.30, Jl.16 SA | X 6.25 |
| Newmont Mining | N. Y. Curb | 217½ | 204 | 210½ | Se.28, Oc.15 Q | 1.00 |
| U. S. Sm. R. & M. | New York | 71⅛ | 62 | 66⅞ | Oc.5, Oc. 15 Q | 0.87½ |
| U.S. Sm. R.&M. pfd. | New York | 54⅛ | 53⅛ | 54⅛ | Oc. 5, Oc. 15 Q | 0.87½ |

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

**LONDON QUOTATIONS—WEEK ENDED November 20, 1928**

| Name | High | Low | Last | Date | Amount | Last Div. |
|---|---|---|---|---|---|---|
| Alaska Mexican ($5) | 20/6 | 20/—20/— | | | | |
| Alaska Treadwell ($25) | 80/6 | 80/—80/— | | Nov., 1926 | 4 (d) | |
| Aramayo Mines (25 frs.) | 62/3 | 60/—60/— | | Nov, 1928 | 5 p.c (†) | |
| Burma Corpn. (10 rupees) | 15/3 | 14/3 | 15/— | Aug., 1928 | 6 annas* | |
| Bwana M'Kubwa (5s) | 9/— | 7/9 | 9/— | | | |
| Camp Bird (2s) | 3/6 | 3/— | 3/4½ | April, 1928 | 16⅔ p.c. | |
| El Oro (£1) | 5/— | 4/7½ | 5/— | Nov., 1924 | 2½ p.c.* | |
| Frontino & Bolivia (£1) | 10/6 | 8/9 | 10/— | Dec. 1928 | 3½ p.c. | |
| Mexican Corpn.(£1) | 9/6 | 8/6 | 9/3 | | | |
| Mexico Mines of El Oro (£1) | 28/9 | 22/6 | 27/6 | Dec., 1926 | 3½ p.c.* | |
| Mond Nickel | 138/9 | 130/—132/6 | | Aug., 1928 | 20 p.c. | |
| Mount Isa (£1) | 33/9 | 31/10¼ | 33/9 | | | |
| N'Changa Copper Mining | 20/7½ | 19/7½ | 20/6 | | | |
| Oroville Dredging (£1) | 5/1½ | 3/10½ | 4/9 | Dec., 1928 | 6½ p.c. | |
| Rhodesian Congo Border (£1) | 34/4½ | 32/6 | 33/9 | | | |
| St. John del Rey (£1) | 12/3 | 11/9 | 12/3 | April, 1928 | 7½ p.c. | |
| San Francisco Mines (10s) | 29/4½ | 28/4½ | 28/9 | July 1928 | 12½ p.c. | |
| Santa Gertrudis (£1) | 14/6 | 14/— | 14/3 | July 1928 | 7½ p.c. | |
| Selukwe (2s. 6d.) | 8/1½ | 7/4½ | 7/6 | April, 1917 | 6¼ p.c. | |
| S. Amer. Copper (2s.) | 2/3 | 1/10½ | 2/1½ | Nov., 1917 | 75 p.c. | |
| Tanganyika (£1) | 65/— | 60/3 | 61/3 | July 1928 | 5 p.c. | |
| Union Miniere du Haut-Katanga (Brussels) | 11,585 | 11,015 | 11,115 | July, 1928 | 182.60 (b) | |

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation.